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A MANUAL OF
MEDICAL TREATMENT

OTHER WORKS BY DR. BURNEY YEO

Food in Health and Disease (11th Thousand)

The Therapeutics of Mineral Springs and Climates

CASSELL & COMPANY, Limited
LONDON, NEW YORK, TORONTO AND MELBOURNE

A MANUAL
OF
MEDICAL TREATMENT
OR
CLINICAL THERAPEUTICS

NEW EDITION

BY

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MANUAL OF MEDICAL TREATMENT

PART IV.—PHTHISIS, OR CONSUMPTION (PULMONARY TUBERCULOSIS)

(CONTINUED)

CHAPTER IV

GENERAL MEDICINAL TREATMENT OF PHTHISIS

Classification of Cases of Phthisis according to their Amenability to Treatment—Conditions of Curability—The Use of Antiseptic Agents—By Inhalation in Inhalation Respirators—Iodine—Ethyl Iodide—Iodoform—Creasote and Guaiacol—Various Modes of Administering them—Inhalation of Creasote Vapour in Compressed Air—Duotal—Creasotal—Turpentine—Chloroform—Eucalyptol—Menthol—Myrtol—Intrapulmonary Injections—Intravenous Injection of Hetol or Sodium Cinnamate—Formalin—Specific Treatment, *Tuberculins* and *Sera*—Calmette's Tuberculin and the *Ophthalmo-reaction*—The Alkaline Hypophosphites—Arsenic—Iron—Cod-liver Oil—Glycerine—Mineral Waters. Additional Formulæ.

THE modern tendency to rely mainly on regiminal means in the treatment of phthisis, that is to say, on measures chiefly directed to improvement of the general nutrition of the patient and the raising of the power of resistance to the infective micro-organism which is the exciting cause of the disease, has led us to precede the consideration of the various medicinal modes of treatment that have been from time to time advocated as remedies for consumption by a review of the most approved regiminal and climatic measures.

We must now attempt to form a just estimate of the many medicinal agents which have been credited with the power of curing or arresting pulmonary tuberculosis.

Such a just estimate will depend on our realising the fact that, from the point of view of **treatment**, cases of pulmonary phthisis, as they come under the observation of the physician, may be roughly classified into—

1. The curable.
2. The remediable.
3. The irremediable.

It is in the nature of pulmonary tuberculosis, if unchecked, to cause progressive destruction of the organ it attacks. If any portion of the structure of the adult lung is destroyed, as Virchow pointed out, it can never be restored to its former state of integrity. If a large portion is destroyed, it must ever remain so. It is clear, then, that the restoration of a lung to its former state of integrity in a case of pulmonary tuberculosis must be of rare occurrence, and if we are to *cure* phthisis, in the generally accepted sense of the word "cure," we must, whatever our remedy may be, treat it in its earliest stage, before it has led to any considerable destruction of lung tissue; but we may *arrest the course* of the disease, and so *remedy* cases, even when the disease is somewhat advanced, and subsequent retrogressive and protective anatomical changes in the lungs may restore the patient to a fairly active and useful life.

But there is yet another condition other than the amount or stage of the local disease which will determine the result of treatment and the classification of the case in regard to it: and that is the original natural power of resistance in the patient to the infecting agent.

A physician who has had a large experience of cases of phthisis often, in his own mind, feels inclined to regard a case as probably irremediable, although he may be consulted at the very earliest appearance of local physical signs. He sees profound constitutional disturbance, and he fears the disease will run a rapid course, do whatever he may. These are cases of acute and subacute phthisis. In these cases, we may believe either that a considerable diffusion of the infective micro-organism has taken place before the development of any recognisable physical signs, or that the invading bacillus has been unusually abundant in amount or of exceptional virulence.

It should, therefore, be remembered that a remedy which may be efficacious in the earliest stage of phthisis is not, in the slightest degree, less a remedy for phthisis because it fails to produce any great result in more advanced cases, or under more unfavourable conditions, either of original constitution or virulence of infection.

Whatever observations we may make with respect to the treatment of phthisis must be regarded as always qualified by the preceding considerations; and we would counsel those who may have to consider the subject of remedial agents in phthisis to keep these truths in their minds.

Briefly, then, the **conditions favourable to cure** in cases of phthisis are these:—(1) *Early recognition* of the disease, when the tubercular lesions are small and circumscribed. (2) The *early occurrence* of hæmoptysis we regard as not an unfavourable condition, chiefly because it calls attention in a striking manner to the existence of this early stage; for it may happen that we can detect few, if any, characteristic physical signs in the lungs at the time of these early attacks of hæmorrhage. (3) A natural tendency in the evolution of the tubercular infiltration to *sclerotic* or *fibroid* changes is a very favourable condition; this tendency may be found pre-existing in the constitution, and may lead to spontaneous cure, or it may be promoted by suitable treatment; such a tendency is often observed in the gouty and rheumatic constitutions. (4) The absence of great tissue sensitiveness or irritability; the absence of that tendency to acute inflammatory reaction to the bacillary infection, the presence of which is so unfavourable a prognostic. (5) The absence of hereditary predisposition, and the possession of a sound, vigorous constitution, which has become accidentally infected with the tubercle bacillus. (6) A mitigated virulence of the bacillary infecting agent, and the small quantity or number that originally gain access to the lungs, and their access through the air-passages rather than through the vascular channels.

The use of antiseptic agents.—We have already formulated the following as one of the indications for the treatment of pulmonary consumption:—

"To endeavour, *so far as possible*, to antagonise the influence of the infective organism on the lung tissues and on the constitution. To attempt to hinder its extension to the sound parts of the affected lung, and also to the sound unaffected lung, and to prevent the infection of other organs."

It is impossible, in the rational treatment of phthisis, to lose sight of the fact that there is an infective organism not only present and multiplying in the lung, *but actually diffused through the mucous* and *muco-purulent secretions in the air-passages;* and, in advanced cavity cases, we have other infective organisms also present, and the conditions of mixed infection to counteract.

We know that the tubercle bacillus, in the vast majority of cases, reaches the lung from without, that it is taken in with the inspired air, and, finding in the lung the conditions suitable to its existence and multiplication, it lives and multiplies there. Now, if we could alter or disturb those conditions, we might hope, if not to arrest its vitality, at any rate to modify and diminish its morbid activity.

There are two channels by which we can attack and influence the infective organism in pulmonary phthisis: one is the very same channel by which it most commonly gains access to the organism, the air-passages of the lungs ; the other is the blood.

There are also, apart from hygienic and regiminal measures, two conceivable methods by which we may influence the life and activities of this bacillus in the lung :—

1. By producing conditions more or less directly hostile to its existence : *i.e.* directly anti-bacillary, although we have been informed by Strauss that "dead tubercle bacilli preserve an energetic deleterious action "—in that case it is the neutralising of their activities that is of chief import.

2. By increasing the resisting power of the pulmonary tissues to its attack.

But it will naturally be asked what has been the practical gain from the use of "*anti-bacillary*" *measures*. It is possible to get good results, or no results, from the use of such agents, according to the amount of judgment exercised in the selection of cases, according to the amount of sincerity, intelligence, and discrimination with which we employ the agents at our command, and according to the amount of co-operation and good faith we encounter in our patients.

We shall often find it impossible, with phthisical patients, to induce them loyally to follow any plan of treatment which requires constant trouble and attention ; and it is extremely difficult to induce patients to breathe almost continuously an antiseptic medicated atmosphere of sufficient concentration and with sufficient continuance to be of any real efficacy.

It has been found since using antiseptic inhalations in the treatment of phthisis, even in fairly advanced cases, that, when used continuously, the progress of the disease is rendered much slower and quieter ; and, compared with our former experience, we find the extension of the disease to the unaffected lung is remarkably delayed. Indeed, it is in preventing the extension of the disease to the hitherto sound lung, and in preventing laryngeal infection, that we consider this method so important; but to expect that any form of antiseptic, or any mode of its application, will cure advanced cases is to expect the impossible, and no such results ought ever to be claimed from their use. Improvement locally and generally and prolongation of life are all that can be expected when lung destruction has advanced to a considerable extent.

Wilson Fox, who was by no means an enthusiast in these matters, says: "There can be no question that inhalation practised in this manner,* with creasote, thymol, eucalyptus, iodoform, iodine, or terebene, tends to diminish cough and expectoration, and that in some cases marked improvement in the patient's state occurs during their use, even in very advanced stages."†

Dr. Frederick Hicks, when resident medical officer to the Brompton Hospital, in a communication to the Harveian Society, spoke thus of his own personal experience: "To obtain the greatest good from antiseptic inhalations, a patient must devote himself very thoroughly to the treatment. Respirators should be worn almost continuously. . . . All patients testified to their use in allaying cough. This effect might be due to merely a sedative action, but also the more probable explanation was that the antiseptic caused diminution of the irritating qualities of the sputum. If this were so, then antiseptic inhalations were rendering a real service in therapeutics."

Professor M'Call Anderson, Professor Oertel, Dr. S. Solis Cohen, of Philadelphia, Professor Dreschfeld, Professor Semmola, Dr. Coghill, of Ventnor, Sir Wm. Roberts, Dr. Dujardin-Beaumetz, Dr. Shingleton Smith, Mr. Mayo Robson, and many others have testified to the value of antiseptic inhalations in phthisis.

The following are the chief volatile antiseptic substances that have been used for inhalation: carbolic acid, creasote, turpentine, terebene, sanitas oil, camphor, iodine, thymol, menthol, formalin, certain essential oils (cinnamon, peppermint, etc.), iodide of ethyl, eucalyptol, oleum pini sylvestris, and iodoform dissolved in ether.

---

* By means of inhalation-respirators.

† "Diseases of the Lungs," p. 884.

Any of these may be used of suitable strength, either alone or in combination. Many may be used in the "dry" form, that is, dropped on the dry sponge of an inhalation-respirator; or in dilute solution or emulsion in the form of a spray; or they may be diffused through an apartment by wetting cloths with them and suspending them in the room or by pouring them on hot water, or on metal plates heated by a spirit lamp, or by playing a hand-spray about the room—these and various other simple ways will suggest themselves to everyone.

We find equal parts of creasote and spirit of chloroform, or equal parts of carbolic acid and spirit of chloroform, on the whole, the most useful; but some patients much prefer the eucalyptol vapour. Iodine we have found very useful in some cases where the creasote vapour had but little effect.

Dr. Coghill recommended for inhalation a tincture of iodine made with sulphuric ether instead of spirit of wine, and he prescribed also a combination with carbolic acid, according to the following formula:—

℞ Tincturæ iodi ætherialis	āā ʒij.
Acidi carbolici	
Spiritus vini rectificati	ad ℥j.

Misce, fiat inhalatio.

As to the best method of inhaling these vapours: of the perforated zinc inhalation-respirator devised by us for this purpose, and described at vol. i., p. 581, Dr. S. Solis Cohen says: "The lightness of this appliance, its cheapness, and its cleanliness commend it as the best device for the purpose offered to the profession. . . . It is one of the most useful, as it is one of the simplest, devices for the inspiration of medicinal vapours." The special merit of this respirator is that it allows of the *free entrance of air* together with the antiseptic vapour.

Great caution requires to be taken with iodine for purposes of inhalation. There seems to be a tendency for it to induce slight hæmoptysis, so as to colour the sputa in tubercular cases, when used too freely. But in purulent bronchitis, bronchorrhœa, and broncho-pneumonia it will be found safe and efficacious.

The inhalation of **iodine** vapour, diffused in greater or less proportions through the respired air, is quite an old expedient in the treatment of phthisis, and it is thought by many that much of the value of applications of iodine to the surface of the chest is due to the inhalation of the vapours given off. We have already quoted a formula for the inhalation of iodine in combination with other antiseptics. S. Solis Cohen considers the inhalation of *ethyl iodide* one of the best means of conveying iodine into the air-passages. He considers it of "special benefit in ulcerative laryngitis, and in assisting the disinfection and healing of pulmonary cavities."

But many of these antiseptic substances have been administered in other ways. **Iodoform** has been largely given internally, as well as by inhalation, in phthisis. The late Prof. Dreschfeld, of Manchester, was one of the first to advocate its use. He gave it in the form of pills (iodoform 1 grain, croton chloral 2 grains, creasote 1 minim), and inhalations (iodoform 20 grains, oil of eucalyptus 20 minims, or creasote 10 minims; rectified spirit and ether, each ½ an ounce). If the pills were not well borne, it was given in cod-liver oil. He suggested also that in the case of young children it might be used as an inunction, made with olive oil or vaseline—a very useful mode of administering this and other remedies too much neglected.* He found older children took it well in powders or pills. In laryngeal phthisis he thought it very useful, especially when applied locally to the ulcers in the form of powder. The results of his observations were that it produced (1) increase of weight; (2) increase of appetite; (3) diminution of cough and expectoration; (4) diminution, or even total cessation, of night sweats; (5) frequently some reduction of temperature.

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* We have found that when a mixture of iodoform ointment and cod-liver oil, in equal parts, is rubbed into the abdominal surface, the iodoform is readily absorbed.

Dr. Shingleton Smith, of Clifton, considers that many cases of advanced phthisis were arrested by its use, and that incipient cases were cured.

We have ourselves found iodoform of great service in many cases, but, given in pills, our experience is that it is very badly tolerated by some patients, on account of the gastric irritation it has excited. In small doses, however, in combination with guaiacol and sweet almond oil, or mixed with cod-liver oil, we have found it well borne. Children take it exceedingly well, mixed with cod-liver oil in the proportion of ½ a grain to 2 drams of the oil; and adults take it for long periods without any difficulty when given mixed with guaiacol and almond oil in capsules, which should be taken immediately after food, or, if at other times, with a tumblerful of milk.

We have already shown in the chapter on *tubercular peritonitis* the great value of iodoform inunctions in that disease.

It would seem probable that there is a real *anti-toxic* action on the part of iodine to the tubercular infection, Dr. Flick * has expressed himself strongly on this point. He says: "By inunction with a solution of some of the rich iodine compounds I have increased my power to deal successfully with tuberculosis fully 50 per cent. over what it was before I began to use these drugs." *Europhen* dissolved in olive oil or cod-liver oil is the preparation he prefers. The following is his formula:

℞	Europhen	ʒij.
	Olei rosæ	♏ij.
	„ gaultheriæ	āā ʒij.
	„ anisi	
	„ olivæ	ad ʒvj.

M. A teaspoonful is rubbed in night and morning.

---

* "Home Treatment of Tuberculosis." *Proceedings* of Philadelphia County Medical Society, February, 1901.

Elsewhere Dr. Flick remarks: "Of the drugs which tend to set up artificial immunity in tuberculosis the most valuable is undoubtedly *iodine.* The literature on tuberculosis, during the last half-century at least, is dotted over with evidence of the curative powers of this drug."*

No other antiseptic has met with such general acceptance and approval in the treatment of phthisis as **creasote**, and now its derivative, **guaiacol**,† is largely used in its stead. It has been employed in the treatment of phthisis for many years, and may be regarded as a direct descendant of the old *tar* treatment, so much in vogue in the eighteenth century. It has steadily gained in favour, and is now perhaps more widely used than any other remedy for phthisis.

It has been suggested that the curative influence of creasote on the tubercular lesions in the lungs is due to its *promoting sclerotic changes.* It diminishes the expectoration, lessens its purulency, and removes any fœtor it may possess; it reduces the extent of the catarrhal lesions, and so lessens considerably the area of the pulmonary changes. It lessens the tendency to hæmoptysis. It tends to clean the tongue, and promotes appetite and the capacity for taking food by its stimulating action on the stomach. But it does not agree with all patients. Some object greatly to its taste, and in some few cases it seems to set up gastric irritation. It has been given in many different forms; one of the most popular is in capsules, mixed with cod-liver oil. Flexible capsules can be obtained, each containing a minim of creasote mixed with 5 or 10 minims of cod-liver oil. From five up to twenty such capsules may be taken in the course of the day, after food, or with a draught of milk. Capsules containing pure creasote are apt to irritate the stomach. *Guaiacol* may be given in precisely the same way, and a quarter of a grain of iodoform may be introduced into each capsule; the latter drug seems to be better tolerated in this form than in any other. Bouchard has pushed the dose of creasote to 40 minims (mixed with cod-liver oil) daily for several consecutive days. It is best to begin with a small dose, and increase it gradually. We have found the following a useful formula for those who do not object greatly to the taste of the drug:—

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* Hare's "System of Practical Therapeutics" (new edition), vol. i., p. 786.

† Creasote of the beech-tree contains 60 to 90 per cent. of guaiacol.

℞ Creasoti puri (*vel* guaiacol)	♏xlviij.
Glycerini puri	ʒij.
Tincturæ aurantii	ad ℥iij.

Misce, fiat mistura.

One teaspoonful (2 minims of creasote) in a large wineglassful of milk and water three or four times a day, soon after food.

It has recently been urged that it is important to *saturate* the system with creasote, and it has been administered in many other ways than by inhalation and by the stomach. A mixture of creasote and cod-liver oil—1 dram of the former to 1 oz. of the latter—or guaiacol $2\frac{1}{2}$ drams mixed with $1\frac{1}{2}$ oz. lard, has been ordered to be rubbed into the armpits daily.

It has been injected into the trachea dissolved in oil (10 to 50 per cent.), and the expedient has been followed by relief of the most troublesome symptoms. Dr. Philip observes * of this method: "It is probable, so far as the lung lesion is concerned, the drug does not act by immediate contact; but the respiratory passages afford an absorbent surface whence the drug may be carried to different parts."

Prof. Loomis thinks it "a valuable remedy for the relief of the bronchial complications of tuberculosis," and we also think it probable that its good effects are partly due to its action on the pus organisms which complicate the tubercular infection in advanced cases.

The external use of guaiacol has been the subject of some interesting observations. When applied over the skin and covered with an impermeable covering, it is quickly absorbed, and in quantities of 30 to 60 minims causes a rapid and considerable reduction of temperature, with profuse sweatings. The temperature, however, soon rises again to the previous level, and this return of pyrexia is usually attended with rigors and much depression. At present the balance of evidence is unfavourable to this method of administering guaiacol, on account of the depression it produces.

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* *Folia Therapeutica*, October, 1907, p. 113.

It has been *injected into the lungs*—10 minims of a 3 per cent. solution in sweet almond oil—at the seat of the lesions (the apex), with an ordinary hypodermic syringe, most minute antiseptic precautions being taken. It has been injected subcutaneously: 5 to 10 drams of a mixture of 2 drams of creasote and 4 oz. of almond oil have been injected into the lumbar region every second day.

But patients do not like these frequent punctures, and as an alternative we have had capsules prepared, each containing $\frac{1}{4}$ grain of iodoform, $1\frac{1}{2}$ minims of guaiacol, and 3 minims of cod-liver oil. One or two or more of those may be taken twice or thrice daily with a wineglassful of milk and water, after food.

We are convinced of the efficacy of creasote and its derivative, guaiacol, in arresting the progress of phthisis in many cases, and its efficacy is not limited to early cases; indeed, it seems to be of greater use in many chronic forms. It does not cure incurable cases, as some would seem to expect, but if properly, adequately, and carefully administered, it does as much in the way of remedying them as seems possible. How it acts it seems premature to determine. It is known that the bacillus of tubercle can with difficulty be cultivated in sterilised blood serum containing $\frac{1}{4000}$ its volume of creasote; and it seems possible that even in moderate doses it may render the lung tissues a less favourable culture medium for this microbe. Its usefulness in advanced cases is very probably dependent to some extent on its influence over the mixed infections which are then at work.

There is yet another method of administering creasote, a method introduced by Professor Germain Sée. It is the combination of the inhalation of creasote vapour with compressed air. The patient is introduced into a compressed air cabinet containing fumigations of creasote and eucalyptus, and he has to remain there from three to six hours daily. This combination, according to Professor Sée, caused an "enormous absorption of creasote* by the whole pulmonary surface, diseased and sound." The beneficial effects appear to have been in some cases very remarkable. Dr. Tapret states that in six out of thirty cases submitted to this treatment the bacilli disappeared from the sputum.

Duotal (guaiacol carbonate) and *creasotal* (creasote carbonate) have been introduced as "free from the noxious by-effects of the plain creasote and guaiacol," but we have really no evidence that they are more serviceable in the treatment of phthisis.

A great number of other antiseptic agents—volatile and non-volatile—have been applied to the treatment of phthisis, and more or less success has been claimed for all of them. Some have had a brief popularity, and have then practically disappeared from use.

The inhalation of *turpentine* (or terebene) is of value in relieving the catarrhal conditions accompanying phthisis, and so diminishing cough and expectoration ; it may be used alone or combined with carbolic acid, eucalyptol, chloroform, or camphor, in the inhalation-respirators already referred to. A small quantity (about 10 per cent.) of *chloroform* is often a valuable addition to many of these antiseptic inhalations. It is itself a powerful antiseptic, and by its ready volatility may help to convey the vapours of the other less volatile antiseptics deep into the air-passages, while its sedative effect is valuable in allaying irritative cough.

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* The air which is pumped into the cabinet to augment the pressure is passed through a mass of shavings saturated with creasote, and is made to take up 1 milligramme of creasote to each litre. During a *séance* of four hours it is calculated that the patient breathes on an average 1 dram of creasote.

Eucalyptol, like guaiacol, has been given hypodermically mixed with sterilised olive oil in the proportion of 1 to 4. Fifteen minims of this mixture are injected daily. It has been found to control septic and febrile conditions, and to diminish cough and expectoration.

Menthol mixed with olive oil (1 to 10) has been administered by *intratracheal* injection. The nozzle of the syringe is introduced between the vocal cords, and as much as a dram at a time of this mixture injected twice a day.

Byrom Bramwell published some excellent results from this treatment. It must be remembered that menthol is a powerful *anæsthetic* as well as an antiseptic.

Intratracheal injections of menthol and creasote combined have been employed on the Continent in phthisis with reported excellent results. The doses used have been large; as much as 30 minims of creasote and 15 grains of menthol, mixed with 5 drams of sterilised oil, have been injected at one time. The patients have been said to support this treatment well, and to suffer no cough or other distress. Good results have also been reported from the continuous inhalation of oil of peppermint, together with the internal administration of the following :—

℞	Creasoti puri	. ♏xxiv.
	Glycerini puri	ʒiij.
	Olei menthæ piperitæ	♏x.
	Spiritus chloroformi...	ad ℥jss.

Misce, fiat mistura.

A teaspoonful to be taken twice a day in a tablespoonful or two of syrup and water.

Myrtol, given in capsules, 2 grains in each, two every second hour, has been found by Eichhorst to influence favourably the course of pulmonary tuberculosis, especially when there is evidence of putrefactive processes in the air-passages.

Intrapulmonary injection of several of these antiseptic substances (creasote, a 3 per cent. solution in almond oil; carbolic acid, a 2 per cent. solution in glycerine; iodoform in olive oil; iodine in weak solution; mercuric chloride in weak dilution; iodine and carbolic acid combined; camphor and carbolic acid combined; camphorated naphthol) has been practised by many physicians, but serious accidents have occasionally attended this method of treatment, and the benefits resulting from it have not been sufficiently great or lasting to recommend it for general adoption.

Intravenous injection of hetol or **sodium cinnamate** in the treatment of phthisis has been enthusiastically advocated by Professor Landerer,* of Stuttgart. The method employed is that of intravenous injection, usually into the cephalic or median vein at the bend of the elbow. The most elaborate antiseptic and other precautions have to be observed. Injections into the gluteal region have also been employed.

Small doses should be used at first, viz. 1 milligramme of a 1 per cent. solution, increasing by ½ to 1 mg. from time to time. The injections are given every other day. The average dose for males is 15 to 20 mg., for women and girls 10 to 15 mg. After a time the 1 per cent. solution is changed for a 5 per cent. solution. The treatment is continued until the bacilli disappear from the sputum—*i.e.* about three months.

One of the drawbacks to the use of *hetol* is that it causes a tendency to attacks of hæmoptysis, and its employment has occasionally had to be suspended for this reason.

Other physicians have obtained some favourable results from this treatment, but not at all in the same proportion as Professor Landerer, and it has been suggested that the results published by him have been largely attributable to the combination of sanatorium treatment with that by hetol.

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* Landerer: "The Treatment of Tuberculosis by Cinnamic Acid." (F. C. W. Vogel, Leipzig.)

The method of *intravenous* injection is that adopted by Dr. R. Maguire in the use of **formalin** in the treatment of phthisis. His idea is to effect a "sluicing of the lung" by as strong a solution of formic-aldehyde as possible. The method, as is admitted by Dr. Maguire, is not without risks, and the technique, as practised and advocated by him, is delicate and difficult. Some experiments on himself by this method were followed by albuminuria, copious hæmaturia, and thrombosis of a vein in the arm.

It must also be borne in mind that when a substance like formic-aldehyde is thrown into a vein, although it mixes first with the blood in the right side of the heart and passes thence to the lungs, it very shortly reaches the left side of the heart, and circulates through all the tissues; and we have to consider what secondary effects it may have on these.

We own to a dislike to *intravenous* administration of drugs, unless in desperate cases, when no other reliable means are available, and we doubt if this method is likely to take a permanent place in the therapeutics of phthisis.

SPECIFIC TREATMENT—TUBERCULINS AND SERA

Tuberculin.—This substance, introduced by R. Koch, as a specific and secret remedy for phthisis, in the autumn of 1890, was soon announced to be a glycerine extract of the products of the cultivation of tubercle bacilli. It was stated by Koch that it acted in a specific manner on tubercle, exerting a selective action upon it, hastening its disintegration, and under appropriate conditions led to the cure of phthisis. The excitement throughout the medical world at this announcement was intense, and the scenes in Berlin which followed, and which we had the opportunity of contemplating, were perhaps the most remarkable in the history of medical science;

but this is not the place to write the history of that premature and unfortunate announcement. Those who saw, as we did, the severe reactions which followed, in many cases, the subcutaneous injections of tuberculin, felt that there must be serious risks attending its general use. It was not long before a sense of profound disappointment succeeded to the enthusiasm excited by the exaggerated statements that had been promulgated; this change of feeling was started mainly by the reports of Virchow and others, supported by many pathological facts, that treatment by tuberculin was attended by serious risks of dissemination of the tubercular virus throughout the body, by the softening and disintegration of quiescent deposits, roused into activity by the severe inflammatory action excited around them. Much discussion followed, and the final result was that the remedial action of tuberculin, not only in phthisis, but in tubercular diseases generally, became discredited, and its use almost universally abandoned.

We must not, however, withhold our own testimony to the fact that in certain carefully selected cases of phthisis, with a very careful use of tuberculin in minute doses, we obtained some excellent results; and if we relinquished its use, it was in deference to the alarm and distrust of the remedy aroused by its antagonists in the minds of the profession and the public; for, hastily and prematurely advocated, it was hastily and almost angrily denounced.

Since this period several tuberculins (including two by Koch) have been introduced into practice in the treatment of localised tubercular deposits and of pulmonary tuberculosis. These are used extensively both for diagnostic and therapeutic purposes, especially in Germany and America, in the treatment of phthisis, but in this country there still exists some opposition to their employment. It is maintained by the advocates of their use that if properly and skilfully employed they are not attended by injurious symptoms, but that, on the contrary, they are convinced, by observation and a large experience, of their *curative* as well as diagnostic efficacy.*

Koch's Old Tuberculin (T. O.) is used especially for diagnostic purposes. The diagnostic dose is very small, $\frac{1}{200}$ c.c. being usually given for the first dose, and, if this fails, $\frac{1}{100}$ c.c. a few days later; but even smaller doses are recommended by some. In positive cases there is a sharp *reaction*, consisting in a rapid rise of temperature, often reaching 104°, accompanied by the usual symptoms of fever, and frequently with shivering. At the same time the local lesions (if visible) will be seen to become swollen and surrounded by an inflammatory zone. The method should not be used unnecessarily—*i.e.* if there are definite physical signs of tuberculosis in the lungs, or tubercle bacilli in the sputum—and should be avoided if recent hæmoptysis has occurred, or if other serious disease co-exists. It is obviously useless when the temperature is very irregular, and should not be employed if it rises above 99°.

It is urged by the advocates of this method that it should be employed in all cases where tuberculosis is suspected, but not definitely diagnosed, the early diagnosis of the disease being of extreme importance with regard to early treatment and possible cure. In Germany the Old Tuberculin is also used as a curative agent, but only in cases quite free from fever and in which the prognosis is favourable, and it is not employed in advanced cases with *mixed infections* and obvious constitutional disturbance.

It is usual, when employing the Old Tuberculin as a curative agent, to begin with $\frac{1}{10000}$ c.c. and to increase the dose gradually until 1 c.c. is given in a single injection. The injections are made every two or three days, the dose being very carefully increased, so that no marked reaction occurs, and they are continued as long as the patient goes on improving under them, or is cured. This treatment is best carried out in a sanatorium. In most cases it will be advisable to repeat the maximum dose at increasing intervals of some weeks after the patient has returned to his former life.

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* The dilutions are best made with sterile normal saline solution containing ·5 per cent. of carbolic acid. When doses of the Old Tuberculin are given by weight, they refer to the fluid as sold, *i.e.* 10 milligrammes = $\frac{1}{100}$ c.c. The weights of the doses of the newer tuberculins refer to the amount of solid substance contained therein: this varies with different preparations, and is stated on the label. T. R. contains 10 milligrammes in 1 c.c.

Of other tuberculins that have been used therapeutically, Koch's New Tuberculin (T. R.) consists of a suspension of pulverised tubercle bacilli, after extraction of the soluble reaction-producing ingredients with normal saline. It is the mildest of the bacillary preparations and is very suitable for the treatment of patients who are abnormally sensitive to injections of T. O., and it may be used to prepare the ground for these. The initial injection should not exceed $\frac{1}{1000}$ milligramme, and the maximum should not exceed 20 milligrammes. The dose should never be large enough to produce a distinct, immediate reaction, and it must not be used in cases with advanced pulmonary lesions.

Still more recently (1901) Koch introduced a third preparation of tubercle bacilli—this is known as "the new tubercular bacterial emulsion." It consists of killed bacilli in normal saline solution with the addition of an equal amount of glycerine. It is said to be the most active of Koch's tuberculins. The initial dose should not exceed $\frac{1}{1000}$ milligramme and should be gradually increased to a maximum as tolerance is established, avoiding any but the slightest immediate reaction to the injections. Its effects are said to be to reduce an existing febrile temperature to normal, and to reduce expectoration, when used in cases not too advanced and without severe mixed infections.

It may be advisable, here, to quote a recently expressed opinion, opposed to the foregoing, as representing the view of a fairly large number of physicians of experience and authority in the treatment of phthisis in this country:—

"I am still unconvinced of the wisdom of attempting to cure pulmonary tuberculosis by the introduction into the body of a further supply of tuberculous toxine. The procedure is, in my opinion, too risky with our present incomplete knowledge of the details connected with the formation of antibodies and the conditions which regulate the specific protective reaction of the leucocytes.

"I am ready to admit that tuberculin may be a valuable adjunct to other treatment in surgical tuberculosis, and possibly in tuberculosis of internal organs other than the lungs, but it is inapplicable to the treatment of pulmonary tuberculosis. I have had quite recently three cases in which, with all precautions which Wright has elaborated, tuberculin injections appeared to light up quiescent mischief in the lungs . . . . I fear we have not the cure of consumption in tuberculin, even when regulated by watching the opsonic index."*

Dr. Philip, of Edinburgh, may also be quoted with instruction as an exponent of the opposite view. After fifteen years of experience he considers the *therapeutic* value of tuberculin considerable. His initial dose of T. O. is 0·0001 gramme; this is usually followed by some reaction, and the temperature is raised 1° or 2°, and the symptoms and physical signs are aggravated. He is disposed to doubt the practical applicability and utility of the estimation of the opsonic index, but considers the dose should be repeated in 7 to 14 days. As a rule greater tolerance is established, and, after several injections, the dose may be increased up to 0·01 gramme or more. This treatment is not advisable in advanced cases with much constitutional disturbance, as all authorities agree. The treatment should be commenced during an apyrexial interval, and it should never be applied to cases with active pyrexia. He has had good results in early non-febrile cases with T. R., beginning with $\frac{1}{500}$ milligramme, and gradually increasing to 20 milligrammes. He speaks highly of Béraneck's Tuberculin. He has had two years' experience with it, and has treated more than fifty cases, and has found it an agent of great therapeutic value, and free from any serious risk.

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* Dr. J. E. Squire, Physician to the Mount Vernon Consumption Hospital, on "Opsonins in relation to the Specific Treatment of Tuberculosis," *Brit. Med. Journal*, June 15th, 1907.

Calmette's tuberculin and the *ophthalmo-reaction.* —The diagnostic method recently introduced by Professor Calmette, of the Pasteur Institute at Lille, has commended itself to some of those who, for reasons already given, have objected to the use of Koch's tuberculin applied by the hypodermic method. Calmette claimed that his method is free from risk, is easily applied, and that, as a general rule, it causes **no** *constitutional disturbance.* It consists in dropping one drop of a 1 per cent. solution of his tuberculin, which may be prepared from the dried powder, into the inner half and lower sac of the conjunctiva. The reaction, when it manifests itself, does so, usually, in from 3 to 10 hours, and consists of, at first, a slight injection of the conjunctiva near the caruncle, and of the caruncle itself, with a little lachrymation. But the severity of the reaction is very variable, from the slight reaction just mentioned, to redness extending over the entire eye, with all the appearances of acute conjunctivitis. The severest reactions have unhappily, in a few cases, been found to give rise to grave ocular trouble. But to avoid the risk of a severe reaction some observers have used a weaker solution—one in 150 or one in 200. One thing is essential, and that is that the eyes shall be free of any disease.

It has been shown that a great majority of cases known to be tubercular give a positive reaction, but a small proportion fail to react; and moreover a positive reaction has not unfrequently been obtained where there has been no suspicion of tuberculosis. It is therefore by no means a conclusive method of diagnosis.

Wright's method of frequently determining the *opsonic* content of the serum during treatment by tuberculin injections has been employed with considerable success in cases of *chronic localised forms* of tubercle (surgical forms mainly), but "how far the principles advocated by Wright are applicable to pulmonary tubercle is not yet determined, as here the factors are extremely complex, the dosage and interspacing of doses being in many cases extremely difficult" (Bulloch). Indeed, so complex and difficult is the method that it can only properly be applied in a sanatorium and by an expert.

Antitubercular sera.—Of the sera that have been advocated and introduced for the treatment of phthisis, Maragliano's and Marmorek's are, perhaps, the best known. They have been largely tested in the treatment of pulmonary tuberculosis, with some reported successes and many reported failures. The high authority on bacteriotherapy we have already quoted (Bulloch) observes: "The attempts to procure curative tubercular sera in animals have been uniform failures. In most cases the serum has been prepared by inoculating horses with dead cultures of T. B., or with various toxic products isolated from such cultures. Many of these produce a general reaction, which is probably due to the presence of small quantities of toxic material still present in the serum."

The Maragliano serum has been carefully investigated at the Henry Phipps Institute for the Study, Treatment and Prevention of Tuberculosis and Dr. Laurence Flick thus reports on it:—

"The work which has been done at the Institute with the Maragliano serum, over a period of two years, seems to be unfavourable to the serum. It will not do, however, to jump at the conclusion from this work that the serum has no value in the treatment of tuberculosis. All we can say is that it is of no practical value according to our present method of using it. Facts crop out here and there, in the work which has been done, suggestive of good and indicative of perhaps better ways of using it. Some of our men seem to think that smaller doses and longer intervals would give better results Our pathologist, by his histological studies of the tissues of cases treated with the serum, has developed a strong bias in favour of the serum, and some of our men who have had a prejudice against it from their use of it in the beginning, are more favourably disposed to it. Under these conditions the Institute will continue its experimental work with the serum."*

In the case of nearly all these specific treatments, we must keep in view the fact that most of the reported successes have been associated with sanatorium and other hygienic methods of treatment. Now, sanatorium treatment *alone* is admittedly capable of curing or arresting certain cases of pulmonary tuberculosis in *the early stage*, and these are the *very same* class of cases that are selected as appropriate for specific treatment. We therefore think there can be little doubt that many cures that have been attributed to so-called specific treatment have been really due to the curative influence of sanatorium life and the methods adopted in these institutions.

The **alkaline hypophosphites** appear to be of value in certain cases of phthisis. In advanced cases, with both lungs involved, they *can only* act as general tonic remedies, and this they will do in certain instances when there is no great amount of general cachexia. They will often be found of great, though temporary, benefit to fair, florid *young* persons who are the subjects of chronic phthisis. They are of much less use to old than to young people ; but to young children, in almost all forms of chronic lung disease, they prove of the greatest service, and especially in the chronic bronchial catarrhs of scrofulous children.

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* Third annual report of the Henry Phipps Institute, Philadelphia, 1907.

In the cases in which they do good their beneficial effect is generally noticed almost immediately. Patients usually say they feel very much better "in themselves," they feel stronger, in better spirits, are more active, eat better, and sleep better. The night-sweats disappear, the cough sometimes disappears also. But, notwithstanding the evident improvement in general health, the physical signs often remain the same, and the amelioration which follows the use of the hypophosphites is, in many cases, only of temporary duration.

The hypophosphite of lime is the preparation we have found most useful. After giving it in various forms and doses, we find the following formula the best :—

℞	Calcis hypophosphitis	gr. iij.
	Glycerini	♏xx.
	Tincturæ quassiæ	♏x.
	Syrupi aurantii	ʒss.
	Aquæ	ad ℥ss.

Misce, fiat dosis. To be taken three times a day, an hour after food.

For young growing children a combination of the hypophosphite of lime and the syrup of the phosphate of iron acts much better than the lime salt alone.

The following formula is calculated for children from eight to ten years of age :—

℞	Calcis hypophosphitis	gr. jss.
	Syrupi ferri phosphatis	āā ʒss.
	Syrupi simplicis	
	Aquæ destillatæ	ad ʒij.

Misce, fiat dosis. Three times a day after meals.

Arsenic, as a remedy for phthisis, has been greatly extolled, especially by French physicians. Jaccoud says "it is *infallible* in its restorative effects" if long persevered in, and that it leads to retrocession of the local lesions. He gives 1 milligramme (about $\frac{1}{60}$ grain) of arsenious acid in pilules (*well prepared and readily soluble*) twice a day at the commencement of a meal, and increases the dose gradually up to

1 centigramme daily; he continues this dose until signs of intolerance show themselves, the chief of which are great feebleness of the lower extremities and great lassitude after walking. He then considerably reduces the dose, and again slowly increases it. Hérard and Cornil complain that *arsenic* does not occupy the rank it merits in therapeutics; they think it has both a local and general good effect in pulmonary tuberculosis: they consider it lessens congestion by its influence on the ganglionic nervous system, and so remedies the hyperæmia and inflammations which develop around tuberculous granulations.

Dujardin-Beaumetz wrote: "I am one of the warmest partisans of the arsenical treatment, and I have myself seen some marvellous results from it."

There is a remarkable unanimity on the part of French physicians as to the value of arsenic in phthisis.

Bartholow considers "we have no single drug of equal utility in the chronic forms of phthisis," but it is useless in cases with "much hectic and rapid degeneration of the pulmonary tissues."

We have not ourselves observed any such brilliant results from arsenic, but it is always worth a trial, especially in chronic cases with accompanying bronchial catarrh. We have not found it of value in the more acute forms, nor in those in which there is a very decided hereditary predisposition, nor in others with a tendency to gastro-intestinal catarrh; but we have found it useful in some chronic forms, and especially in those which appear to have had their starting-point in catarrhal and congestive attacks of one apex with pleuritic adhesions, in patients with rheumatic tendencies. Given in combination with alkalies (as in the Bourboule water), we have found it beneficial in relieving the catarrhal symptoms and improving the general health.

Most extraordinary claims were advanced by Professor Armand Gautier, of Paris, on behalf of *cacodylate of sodium* in the treatment of phthisis. He maintained that arsenic in this form can be taken, in very much larger doses, with advantage and impunity, than in the usual preparations. Beginning with 2 centigrammes, and gradually increasing this dose, as much as 10 centigrammes have been given daily by hypodermic injection, without producing, it is stated, any untoward effect.

Statements appeared in the public Press of the most exaggerated nature as to the success attending this mode of treatment, but trustworthy confirmation of these reports has not been forthcoming.

As to the value of **iron** in the treatment of phthisis, many differences of opinion have existed, but there is a general agreement that it must not be given where a tendency to hæmoptysis exists In such patients the cardio-vascular system is often very excitable, and the administration of iron, by stimulating the cardiac irritability, may be the means of inducing that hæmorrhage which it is one of our main objects to avoid. But in some of the subjects of chronic phthisis, especially in poor, anæmic, and underfed patients, the value of an iron tonic is remarkable, and it may be given, with advantage, for long periods at a time.

A good form for this class of patients is the following:—

℞	Liquoris ferri perchloridi	♏ xx.
	Spiritus chloroformi	♏ x.
	Infusi quassiæ	ad ℥j.

℥ss vel ℥j pro dose.

The stronger preparations of iron are not, however, well borne by the better-fed and more delicately nurtured subjects of phthisis, nor is the above mixture suitable to febrile or dyspeptic cases. It is in the torpid, chronic forms of phthisis, attended with profuse expectoration from co-existing bronchial catarrh, that it is so useful.

A good form in which to administer iron to phthisical children and young adults is the well-known compound syrup of the hypophosphites ; a teaspoonful twice a day an hour after food.

For scrofulous young people the syrup of the iodide of iron is the best form to prescribe, in half a teaspoonful or teaspoonful doses, after food, twice or thrice a day.

Cod-liver oil is a valuable remedy for phthisis under certain conditions. It is especially useful in the treatment of the poor and ill-fed ; it supplies the place of food in such cases. It is not, however, so much the practice now, as it once was, to order *all* phthisical patients to take this oil as an essential and indispensable part of their treatment, as it is certainly possible to find other means of maintaining and augmenting the nutrition of the body Most English physicians also give it in smaller doses than they used to—two teaspoonfuls twice a day is now an average dose. It is always a favourable point in the case if the patient takes the oil willingly, and digests it easily, for this indicates a satisfactory state of the organs of digestion and the absence of fever. Cod-liver oil is ill borne, and therefore of little use, in cases of febrile phthisis. The absence of fever and the quiescence of the local affection favour its digestion and absorption. On the other hand, gastric debility or the existence of gastric or intestinal catarrh, so common in the more active forms of phthisis, and sometimes associated with the chronic form, counter-indicates the use of the oil, or calls for its suspension. As a good *general* rule, we should prescribe cod-liver oil in all cases in which it is certainly well borne and easily digested, and we should withhold it in all cases in which it is ill borne and digested with difficulty. In children and young people, especially if they present signs of the scrofulous constitution, we should urge its use, and not allow it to be hastily set aside. Where it agrees well its good effects are soon manifested in increase of appetite, improved vigour, greater capacity for exertion, and increase in body-weight.

As a prophylactic, its regular use in small quantities should be urgently recommended for all young, delicate, and scrofulous children. If its use is begun when the children are very young, we rarely find any objection made to its taste in after-years, so that a tolerance of the remedy is early established.

The difficulty which some patients experience in taking the oil has led to many practical suggestions as to the best mode of giving it so as to overcome the repugnance felt to it.

A great number of emulsions of cod-liver oil and mixtures with malt extract are now prepared, and many of them are well made, and more easily digested by some patients than the pure oil.

The use of mineral waters.—The treatment of phthisis is undertaken at many Continental spas, and, although the evidence at our command on this subject is unusually conflicting, we cannot pass over in silence methods of treatment which have so many advocates.

The following comprise the chief spas which have been recommended for the treatment of phthisis:—

1. *Sulphur* springs, as Eaux Bonnes, Cauterets, St. Honoré, etc.

2. The *alkaline bicarbonate of soda* waters—most of them containing also small quantities of chloride of sodium—as Ems, Salzbrunn, Neuenahr, Gleichenberg.

3. The *arsenical* waters, as La Bourboule, Mont Dore, Royat. These also contain bicarbonate of soda and chloride of sodium, like the second group.

4. *Saline, or common salt* waters, as Soden, Reichenhall, Salzungen, Kreuznach.

5. *Sulphur and salt combined*, as Uriage, Aix-la-Chapelle, etc.

6. *Lime* waters, as Weissenberg and *Lippspringe.*

The *alkaline bicarbonate of soda* waters are chiefly useful in the treatment of the chronic bronchial catarrh of phthisical patients who are free from fever.

Ems, which was at one time regarded as a suitable resort for such cases, is now universally prohibited in phthisis on account of its situation and climate.

Salzbrunn, in Silesia, 1,220 feet above the sea, and sometimes termed the "cold Ems," is better situated, and forms an appropriate summer resort for cases of old stationary phthisis associated with catarrhal and dyspeptic symptoms.

Gleichenberg, in Styria, has also a very mild climate and a moist atmosphere, and the same kind of water as Ems, only more strongly mineralised. Inhalations are practised there, and the place is well adapted to the cases indicated above.

The "*sool*" or *common salt* waters, and the inhalation of the salt-impregnated atmosphere which surrounds the graduation works commonly found at these spas, or of the pulverised saline water in the inhalation-chambers, are useful in the treatment of the chronic bronchial catarrh which accompanies most cases of chronic phthisis. The saline solutions appear to produce a stimulating effect on the bronchial nerves, "causing vigorous contraction of the muscles, and thus promoting expectoration," while the water inhaled "softens the secretions and the epithelium."

The cases which derive the greatest benefit from such establishments as the Reichenhall Inhalatorium, in which the air is strongly charged with saline spray, are "old bronchial catarrhs, bronchial dilatations, and stationary cavities, with abundant secretion."

Sulphur waters have always enjoyed a great reputation in France in the treatment of phthisis, and they appear to have proved of service in suitable cases. The warm springs of Eaux Bonnes, Cauterets, St. Honoré, Amélie, etc., are the most in repute.

In all these spas it is usual to drink a small quantity of the water at first, only 1 or 2 ounces, which is increased when well borne by the patient to two or three glasses a day. In some there are inhalation-chambers filled with the pulverised water, or with gaseous sulphuretted hydrogen, separated from the water by mechanical means, and in these the patients remain for a certain time. Baths, half-baths, foot-baths, and hot douches to the lower extremities are applied in most of these resorts.

The effect of these sulphur waters is considered to be in a special manner *anti-catarrhal.* They both promote expectoration and diminish its quantity. They are considered also to possess anti-scrofulous and anti-lymphatic properties, to act as tonics to the skin (when taken as baths), and to remove that excessive impressionability of the surface so common with the phthisical, and so to protect them from their tendency to bronchial catarrh. And, ultimately, they are believed to have a general stimulating and tonic effect. With some persons they set up digestive troubles and loss of appetite; therefore the stronger waters should always be diluted, either with milk or a little syrup and water.

The sulphur cure is especially suited to cases of phthisis in scrofulous or lymphatic persons: the form that has been termed "torpid phthisis." The general health should not be gravely compromised; there should be an absence of fever; slight febrile excitement is not, however, a counter-indication; but there should be no tendency to congestion or hæmoptysis.

Spas, such as *Uriage*, *Allevard*, etc., whose waters contain chloride of sodium, as well as sulphur compounds, are especially suited to the treatment of those scrofulous forms of phthisis associated with swelling and suppuration of lymphatic glands.

Of the *arsenical springs*, such as Mont Dore, Royat, and La Bourboule, it is only in the last that arsenic exists in quantity sufficient to induce the belief that this constituent plays an essential part in the effects produced. The Royat and Mont Dore waters are warm weak alkaline springs containing a small quantity of chloride of sodium; indeed, Royat has been called "the French Ems."

The good results reported to have been obtained in the treatment of certain cases of phthisis at

Mont Dore are probably referrible, as at other spas where the inhalation of an atmosphere saturated with vapour of water is an essential part of the treatment, to the influence of the methods employed there on the catarrhal affection, on the secretions and inflammatory exudations which are retained in the air-passages; and it is highly probable that many of these cases have not been truly cases of tubercular phthisis, but chronic catarrhal and congestive conditions of one or other apex, together with apical pleuritic adhesions a pathological condition not uncommonly encountered as a result of acute catarrhal attacks in rheumatic subjects. Cases of chronic phthisis in the fairly robust, complicated with a tendency to asthma, are those best suited to the Mont Dore cure.

La Bourboule has been found very useful in the treatment of enlargement of the bronchial glands in strumous children.

ADDITIONAL FORMULÆ

Arsenic and iron drops in phthisis

℞ Liquoris arsenicalis, ʒj.
Tincturæ ferri malatæ, ʒv.
Glycerini, ʒv.

M. Fifteen drops twice a day after meals. (*Schnitzler.*)

Creasote mixture

℞ Creasoti puri (Morson's), ʒss.
Spiritus cinnamomi, ʒiv.
Tincturæ aurantii, ℥ijss.
Glycerini ad ℥iv.

M. f. mist. A teaspoonful in a little water three times a day after food. (*Whitla.*)

Another

Beechwood creasote, 32 to 80 minims.
Glycerine, 2 to 4 oz.
Tincture of cardamoms, 2 to 4 drams.
Alcohol, 1 to 8 oz.

Mix. Two to four teaspoonfuls in three or more ounces of water three to five times a day after food. (*S. Solis Cohen.*)

Inhalation in phthisis

℞ Iodoformi, gr. xxiv.
Creasoti puri, ♏iv.
Olei eucalypti, ♏viij.
Chloroformi, ♏xlviij.
Alcohol. et ætheris q.s. ad ʒiv

M. f. inhal. (*Robinson.*)

Mixture for phthisis

Oil of gaultheria, 2 minims.
Creasote, 5 minims.
Donovan's solution, 5 minims.
Cod-liver oil, 2 drams.
Acacia }
Sugar } a sufficiency.
Water to make an emulsion of half an ounce.

Mix. After meals three times a day. (*S. Solis Cohen.*)

Tannin wine for phthisis

Tannic acid, 80 grains.
Glycerine, 1 oz.
Wine, 1 quart.

A claret-glassful after each meal.

(*Raymond and Arthany.*)

Biniodide of mercury spray for inhalation

℞ Hydrargyri biniodidi, gr. vijss.
Tincturæ opii, ʒijss.
Aquæ destillatæ, ℥xxx.
M. To be used as a spray.
(*Miquel.*)

Antiseptic hypodermic injection

℞ Acidi carbolici, partes v.
Eucalyptol, partes v.
Iodoformi, partem j.
Vaselini (liquidi) ad partes c.
M. (*Meunier.*)

Iodoform and creasote pills

℞ Iodoformi }
Creasoti }
Pulveris benzoini }
Pulveris balsami tolutani } āā gr. ¾

To be made into a pill and coated with sugar. Two to four daily. (*Huchard.*)

CHAPTER V

SYMPTOMATIC TREATMENT OF PHTHISIS

Counter-irritation—Flying Blisters—Iodine—Paquelin's Cautery. *Treatment of Fever*—Quinine—Digitalis—Salicylic Acid and Sodium Salicylate—Antipyrin—Phenacetin—Pyramidon, etc. *Treatment of Night-Sweats*—Different Forms of Sweating—Hypophosphite of Lime—Quinine—Digitalis—Arsenic—Cold Sponging—Zinc Oxide—Sulphuric Acid—Perchloride of Iron with Strychnine—Dover's Powder—Belladonna—Atropine—Camphoric Acid. *Treatment of Cough*—Forms of Cough—Need for Caution in the Use of Opiates—Alkaline Drinks to Promote Expectoration—Inhalations, Balsamic and Sedative—Counter-irritation—Sedative Syrups, etc. etc. *Treatment of Vomiting*—Explanation of its Causation—Management with regard to Food, etc. *Treatment of Hæmoptysis*—Tendency to Spontaneous Arrest—Different Forms—General Management—Ergot—Gallic Acid—Turpentine—Sulphuric Acid with Aperient Sulphates—Perchloride of Iron—Digitalis—Aconite—Adrenalin Chloride—Calcium Chloride—Gelatin—Nitro-glycerine—Acetate of Lead—Common Salt—Ipecacuanha—Local Application of Cold—Opium and Morphine—Aperients—Blood-letting—Blistering—Alcohol—Prophylactic Measures. *Treatment of Disorders of Digestion*—Loss of Appetite—Dyspepsia—Pyrosis—Constipation—Gastralgia—Diarrhœa. Additional Formulæ.

One of the most efficient means we possess for relieving the *symptoms dependent on the pulmonary congestion and inflammation* and the apical pleuritis which so constantly accompany pulmonary tuberculosis is **counter-irritation.** It is often attended by manifest relief of cough, diminution of fever, relief of pain, and marked improvement in the local physical signs.

The best mode of counter-irritation is the repeated application of flying blisters. Two or three small blisters, about the size of a penny-piece, are placed over the area of dulness, or the affected portion of lung; they are applied in succession over different but contiguous spots, and retained from two to four or five hours, according to the delicacy of the skin; redness of the skin rather than vesication being aimed at, so that the blistering may be frequently renewed over the same spots. In this way a small blister may be moved, from spot to spot, over, for instance, the supra- and infraclavicular regions in front, and over the supraspinous and interscapular regions behind. When the whole of the desired surface has been blistered, a few days' rest may be allowed until the skin is again in a condition to bear a renewal of the counter-irritation. Subsequently the counter-irritation may be kept up by the application of iodine. For this purpose it is best to use a mixture of equal quantities of the *tinctura* and the *liquor iodi fortis* of the B.P. The former is too weak and the latter too strong to be used separately. It is advisable to avoid painting each day the *same* area; it is best to choose one area one day, another the next, and so on.

A very favourite method of applying counter-irritation in France is the rapid application of the actual cautery, in the form of a white-hot pointed cone of metal; that invented by Paquelin, and called Paquelin's cautery, is usually employed. By its means a number of small pointed cauterisations can be rapidly made and frequently renewed. It has the advantage of being clean, rapid, and almost painless. It is usual to make about twenty to thirty of these cauterisations, under one or both clavicles, every five days. We greatly prefer these methods to croton oil liniments, or tartarised antimony ointment.

Fever is one of the most important symptoms we are called upon to treat in the progress of a case of phthisis, as it is almost certain to be present in some part, if not in the whole of its course. So long as the fever remains uncontrolled, we know that the "*consumption*"—*i.e.* the exhaustion of the patient's strength and the wasting of his substance—must go on. Indeed, we rightly test most of our remedies for phthisis by the thermometer. All those remedies which have been described under the head of "general" remedies, when they succeed in influencing favourably the progress of the disease, have the effect of lowering the febrile temperature. In so far as the fever may be dependent on congestion or inflammation of the surrounding lung tissues, counter-irritation in relieving or modifying these conditions will also have the effect of lowering the temperature; in many cases prolonged exposure to open air will, in course of time, bring down the temperature. As a general rule it may be laid down that a patient with a temperature over 101° F. should be kept absolutely at rest in the open air or in an apartment exposed to the open air.

But, besides general and local remedies, there are others which have been specially used on account of their influence, more or less direct, over the febrile process.

Quinine and *digitalis*, together or singly, have been largely used as antipyretics in phthisis. We have ourselves employed them very extensively in the treatment of phthisis, and have often found them of real value. One drawback to their use, however, is that in certain patients they produce some gastro-intestinal irritation; this is more frequently the case when digitalis is given in the form of powder.

Niemeyer strongly advocated the combination of quinine and digitalis in the fever of phthisis, especially when it assumes a somewhat periodic form, with marked evening exacerbations ushered in by chills.

The advantage of using quinine as an antipyretic, in comparison with other proposed remedies, is that it acts as a general tonic, and while it checks the fever, it also, in small doses, improves the appetite.

We have found the following combination improve appetite, increase strength, and keep down the fever and night-sweats, especially in young patients :—

℞ Quininæ hydrochloridi	gr. ij.
Calcis hypophosphitis	gr. iv.
Tincturæ nucis vomicæ	♏x.
Tincturæ aurantii	ʒss.
Glycerini	ʒss.
Aquæ	ad ℥j.

Misce, fiat dosis. To be taken half an hour before meals three times a day.

Another remedy for the fever of phthisis which has found many advocates is *salicylic acid* or *sodium salicylate.* We do not think them so useful as quinine, and they have the disadvantage of being depressing ; it is however, possible that they may exert an antiseptic effect in advanced cavity cases, with mixed infection, associated with the presence in the lungs of pyogenic micro-organisms.

Antipyrin has been largely used to reduce the temperature in febrile forms of phthisis ; but nervous depression, vomiting, occasional profuse sweatings, great lowering of cardiac power, are effects of its use that have been recorded by many different physicians.

As an adjunct to our means of controlling rises of temperature in phthisis, a few small doses of antipyrin may be certainly of value, but we must watch carefully its effect both on the patient and on the temperature.

We greatly prefer *phenacetin* in small doses—2 or 3 grains—in combination with hydrobromide of quinine—2 to 4 grains—three times a day ; this combination we have found useful in reducing temperature in phthisis, without causing any appreciable depression. *Pyramidon* in 5- to 10-grain doses every four or five hours is largely used in Germany for overcoming pyrexia in phthisis. It is less depressing than antipyrin, and its effects are more lasting.

Cryogenine in 5- to 10-grain doses twice or thrice daily has also been found useful.

Sponging with cold or tepid water containing a little eau-de-cologne and vinegar, especially over the chest and between the shoulders, often proves most useful and refreshing.

A little alcoholic stimulant, a tablespoonful of whisky or brandy with milk, given a short time before the expected rise of temperature, is a good expedient in many cases.

Inunctions of guaiacol mixed with olive oil (1 in 12) have been advocated by some physicians, but we think it too depressing an expedient.

Closely connected with the fever of phthisis are the **nocturnal perspirations.**

These are reported to occur with comparative rarity in patients submitted to open-air treatment in sanatoria. They may be arrested or diminished by a variety of means. The appropriateness of the remedy will depend on whether the nocturnal perspiration is the termination of a crisis of hectic fever, or whether it is simply the result of exhaustion, or a consequence of a special condition of the skin common in phthisical patients. Those who regard these perspirations as exclusively symptomatic of fever and toxæmia should bear in mind that in certain persons profuse perspirations are produced by causes quite independent of fever, and associated apparently with a peculiar condition of the skin; that they are a not uncommon symptom during convalescence from any acute exhausting disease, especially influenza, as well as in all states of general debility. Moreover, sleep itself appears to have a curious direct influence in the production of these perspirations in many cases, as they will often occur during the daytime if a phthisical patient falls asleep. Then again, the sweatings at night are often associated with violent fits of coughing, and would seem to be induced by them, the muscular efforts associated with protracted fits of coughing in these debilitated subjects giving rise to profuse perspiration. Sometimes they may be provoked by the bed-clothes and night-dress being too warm and heavy. This should be inquired into, and corrected if necessary.

If we are careful to bear in mind that the nocturnal perspirations of phthisis may depend either on toxæmia, or on a peculiar condition of the skin, or on simple debility, or finally on the exhausting effects of severe paroxysms of cough, or on a combination of two or more of these factors, we shall be able to understand how it happens that different remedies succeed in checking these perspirations in different patients.

When, as in many cases, the sweatings are found to come on regularly at a certain fixed hour of the night, generally from 2 to 4 a.m., it is pretty safe to regard them as connected with the daily febrile paroxysms. If, however, the patient states that *whenever* he wakes up from sleep at any time, day or night, he finds himself bathed in perspiration, it must be looked upon as dependent, partly at least, on exhaustion, or associated with a peculiar condition of skin. Remedies, therefore, directed to the improvement of the general constitutional state, to the relief of the exhaustion, and the promotion of nutrition, will often prove more effectual than any other means in arresting these perspirations. We and others have noticed that the administration of the *hypophosphite of lime* in the manner already directed leads to the cessation of the nocturnal perspirations in some young patients in from ten days to three weeks.

When the evening temperature is high (the rise of temperature frequently commences early in the afternoon), from 102° to 103·5°, and the night sweats appear to be undoubtedly febrile, as we have already said, quinine or a combination of *quinine and digitalis* proves a valuable remedy. The quinine, however, should not be given near bed-time, as it often provokes sleeplessness, and aggravates the night cough; and digitalis, if given for long periods at a time, is very apt to cause gastric disturbance. Another drawback to the use of quinine is that it very frequently excites headache in phthisical patients. It is, however, a valuable remedy in treating the pyrexia, and the associated night-sweats, in a large number of cases of phthisis.

The two following are useful forms for the administration of quinine and digitalis :—

℞ Quininæ hydrochloridi	gr. iij.
Acidi hydrochlorici diluti	♏v.
Tincturæ digitalis	♏x.
Spiritus chloroformi	♏x.
Aquæ cinnamomi	ad ℥j.

Misce. fiat dosis. To be taken twice a day (about 12 and 6), an hour before meals.

Or ℞ Quininæ sulphatis	gr. iij.
Pulveris digitalis	gr. ss.
Extracti lupuli	quantum sufficiat

ut fiat pilula. To be taken twice a day at the same hours.

To patients who do not bear quinine well, *arsenic* may be given : arsenious acid $\frac{1}{50}$ grain, or arseniate of iron $\frac{1}{12}$ grain, in a pill, three times a day, may be prescribed. When the perspirations appear to depend upon exhaustion, light food with some alcohol taken at bed-time, or about 2 or 3 a.m., such as a breakfast-cupful of arrowroot or beef-tea, or milk, with a table-spoonful of brandy or whisky, will often greatly diminish this tendency.

We have often proved the efficacy of rapidly sponging the whole of the body, or only the chest and back, at bed-time with cold water to which some vinegar and eau-de-cologne have been added ; or a lotion may be prescribed as follows :—

℞ Spiritus vini rectificati	āā ℥ij.
Acidi acetici diluti	
Aquæ floris aurantii	℥xij.

Misce, fiat lotio.

This may be further cooled, when used, by the addition of a little ice. It may be rendered more astringent by adding 2 grains of alum to the ounce. Dusting the skin with tanniform powder has been recommended.

Of the various *astringent* remedies that have been recommended for the relief of the night-sweats of phthisis, none is so deservedly popular as *zinc oxide.* It may be given by itself in the form of pills, in 5- or 10-grain doses, at bed-time; or it may be advantageously combined with extract of henbane, which appears to increase its effect.

The aromatic sulphuric acid in 15- or 20-minim doses, in cinnamon water, at bed-time, is a useful remedy in slight cases.

In chronic cases the *perchloride of iron* in 15- to 20-minim doses thrice daily is valuable for its astringent as well as its general tonic effect, and the addition of 3 to 5 minims of *liquor strychninæ* increases its usefulness. The dilute phosphoric acid has also had its advocates. It should be given in 15- or 20-minim doses three times a day.

When the nocturnal perspiration is produced by paroxysms of coughing, medicines which allay the cough and procure sleep alleviate the sweating. It is probably in this way that *Dover's powder* exercises a beneficial influence over the night-sweats in many cases. It may be given (without the sulphate of potash) in the form of a pill, containing a grain of opium and a grain of ipecacuanha, at bed-time. It will often arrest the night-sweats during its administration, but they return immediately it is omitted; and it has this serious drawback, that owing to the specific action of the opium in diminishing the secretion of the bronchial mucous membrane, thick tenacious mucus accumulates in the air tubes during the night, in some cases, and causes much coughing during the early part of the day to expel it.

The influence of *belladonna,* or *atropine,* in diminishing cutaneous secretion is well known. It is, in many cases, a very effectual remedy for this symptom; but in others it fails to produce any decided effect, unless it be given in doses sufficiently large to produce most unpleasant results. Many patients object to the dryness of the throat and unpleasant taste in the mouth, and disturbances of vision, which it frequently causes. It may also set up gastro-intestinal irritation. Nevertheless, with all these drawbacks, it is a most valuable resource in the treatment of the nocturnal perspirations of phthisis. It may be given subcutaneously in the form of atropine injections, from $\frac{1}{200}$th to $\frac{1}{60}$th of a grain. The succus belladonnæ also answers well, in doses of from 10 to 30 minims. Or the tincture and the extract may be employed.

A number of other remedies, which need not be mentioned, have been suggested for the night-sweats of phthisis. Camphoric acid is perhaps the best of these, and may be given in cachets in doses of 15 to 20 grains. Some prefer spirits of camphor (15 to 20 minims) as less irritating to the stomach.

Nothing is of greater importance in the management of a case of phthisis than the proper treatment of the **cough**, especially when this symptom takes, as it frequently does, a prominent place in the sufferings of the patient. Pidoux, who had an exceptional experience in the treatment of phthisis, says:* "It is impossible to possess too many means for repressing a symptom which so exasperates the disease." But in treating the cough of phthisis it is necessary to be discriminating. In the first place, we must constantly keep in view the fact that the cough of phthisis may be either—

(*a*) Simply a cough of expectoration: *i.e.* a cough with an object, that object being to rid the air-passages of infective secretions which have accumulated in them, and which offer an impediment to respiration; or it may be

(*b*) Purely a cough of irritation, a *dry* cough, which is not accompanied or followed by expectoration; or it may be

(*c*) Both a cough of expectoration and a cough of irritation; and this last is the kind of cough we, in nine cases out of ten, have to deal with in phthisis.

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* "Études Générales et Pratiques sur la Phtisie," p. 428 (2nd edition).

We should especially guard against the error of treating the cough of phthisis as purely a cough of irritation, to be overcome solely by the use of sedatives, such as opium, etc.

We do not undervalue the usefulness of opium, morphine, heroin or codeia in the treatment of phthisis; for there are few cases of this disease that do not need, in some part of their course, the cautious use of opium or its derivatives. It has been said that "without opium the treatment of phthisis would be impossible." But by bearing in mind the relation of cough to expectoration, we shall best be guided to its correct management. So long as the cough is always attended with expectoration, we must be very careful in the use of opium, for opium, by diminishing bronchial secretion, causes an inspissation of the mucus in the air-passages, and makes it more tenacious and more difficult of expulsion. If a considerable dose of opium has been given overnight the patient on waking in the morning is often harassed with fearful paroxysms of coughing; coughing which has for its object the expulsion of the tenacious, inspissated mucus that has accumulated in the air-passages during the profound opium sleep.

The morning cough of phthisical patients is almost invariably a cough of expectoration, for in most cases of phthisis there is a tendency to tracheal and bronchial catarrh, and during the hours of sleep the catarrhal secretion accumulates, and on waking has to be expelled. To endeavour to allay this morning cough by giving opiates is commonly to do harm, for the expectoration is hindered or put off, to become more difficult when the temporary anæsthesia of the bronchial mucous membrane which opium induces has passed away; moreover, when opium is given at this morning hour, appetite and digestion are injuriously affected for the whole day.

The best mode of dealing with this morning cough is to promote the expectoration of accumulated secretion by giving warm alkaline drinks, to which a little alcohol may be added. It is the property of warm alkaline solutions to promote expectoration by their solvent action on mucus, and the tenacious mucus accumulated during the hours of .sleep is thus rendered more fluid and easy of expulsion. Equal parts of warm milk and Ems or Apollinaris or Bourbonle water to which one or two teaspoonfuls of brandy or whisky or rum have been added form an excellent drink for the purpose. Or, if more convenient, a dose or two of a mixture containing 10 grains of sodium bicarbonate and 3 grains of common salt, with 20 minims of spirit of chloroform in each dose, may be given with a little hot water or hot milk and water, until the matters to be expectorated have, in a great measure, been got rid of.

If the morning cough is treated in this way, the paroxysms, as a rule, are soon over, and a long period of comparative freedom from cough is commonly ensured.

In association with warm alkaline drinks, the inhalation of some stimulating balsamic vapour for a few minutes, together with the steam of hot water, will promote the object in view, and make it more complete, and secure a prolonged period of immunity from cough. The oleum pini sylvestris, sanitas oil, terebene, and tincture of benzoin are all useful in this way.

But, on the other hand, there are many cases, especially of advanced phthisis, in which, after the discharge of much expectoration, an irritable condition of the mucous membrane of the air-passages remains, and a cough of expectoration is succeeded by a cough of irritation. It may be necessary to inhale a few drops of chloroform, or to give some sedative syrup to relieve this; and we may have the less hesitation in prescribing this when we know we have already contributed to the clearing away of accumulated secretion in the air-passages.

Cough of this kind is often relieved by inhaling from an oro-nasal respirator a few drops of a mixture of *chloroform*, or spirit of chloroform and carbolic acid. So also, in some cases of phthisis, and especially in early stages, and when some dry pleurisy is found over one or other apex, or when early interlaryngeal changes have shown themselves, we may have to deal with a cough which is often purely irritative, and unattended with any expectoration; this kind of cough is peculiarly distressing to the patient, because it is without aim or object, and sometimes with little or no intermission. It is often exceedingly troublesome and fatiguing during the night, preventing sleep, and inducing feverishness and profuse, exhausting perspirations. We must spare no effort to relieve this form of cough.

When there is evidence of the existence of dry apical pleurisy—and the signs must be especially looked for in the supraspinous fossæ—counter-irritation will often prove a valuable remedy. It may be applied in the form of strong iodine paint, or, better, as small flying blisters, moved about from one spot to another over the apex, in front and behind, and repeated from time to time.

But in treating this form of cough we must be prepared for the necessity of frequently changing or modifying our remedies. Butyl chloral is a useful remedy, and may be given in 2- to 5-grain doses made into a syrup, with a little glycerine, syrup of tolu, and camphor water. *Chloral hydrate* and *bromide of potassium*, together or separately, have been found to relieve this form of cough. These remedies find their appropriate use in the case of phthisical patients of neurotic or hysterical temperament. They should be given at bed-time in 5- to 15-grain doses—the chloral acts best when combined with sodium bromide. It is advisable to reserve this remedy for occasional use, and give some other in the interval. Given about every third night, it frequently proves a valuable help in advanced cases.

We have found *belladonna* of great service in relieving the cough of phthisis, and the following form is a good one:—

℞ Succi belladonnæ	āā ʒj.
Spiritus chloroformi	
Mucilaginis et syrupi	ad ℥jss.

Misce, fiat mistura. Take one or two teaspoonfuls for a dose.

This remedy, given at night, has the further advantage of checking the tendency to night-sweats. It is useful in all forms of phthisical cough, but most so in those cases in which there is both excessive secretion, which it diminishes, and excessive irritation, which it allays. Opium and belladonna combined often act better than either separately; they correct one another. A pill containing $\frac{1}{3}$ to 1 grain of extract of opium with $\frac{1}{4}$ to $\frac{1}{3}$ grain of extract of belladonna may be given at bed-time.

Heroin is now largely used as a substitute for morphine, and appears to have a special effect on the respiratory centre; it is a valuable remedy for the cough of the phthisical.

Codeina is a most useful sedative, as it does not disturb the functions of the stomach and liver, as preparations of opium and morphine often do, and it calms the cough in most cases. The dose of codeina is from $\frac{1}{3}$rd of a grain to a grain. One or two teaspoonfuls of the syrupus codeinæ may be taken occasionally.

The following combination of cherry-laurel water, aconite, and opium will often relieve the cough better than opium alone:—

℞ Extracti opii liquidi	♏lxxx.
Tincturæ aconiti	♏xxxvj.
Aquæ laurocerasi	ʒij.
Syrupi	ad ℥jss.

Misce, fiat syrupus. One teaspoonful for a dose.

A simple means of calming the cough of laryngeal irritation is sipping iced water; but it is often necessary in such cases to apply a solution of nitrate of silver (10 grains to the ounce) to the epiglottis and glottis. When the cough is due to irritation or hypersensitiveness of the pharynx, as it sometimes is, combined with laryngeal irritability, the pharynx and larynx being both the seat of an irritative catarrh, a good plan is first to wash away the catarrhal secretion with a warm borax gargle, and then brush lightly the mucous membrane of the pharynx and larynx with the following solution :—

℞ Cocainæ hydrochloridi	gr. v.
Morphinæ hydrochloridi	gr. j.
Glycerini	ʒij.
Aquæ camphoræ ... ... ad	℥j.

Misce, fiat solutio.

The morphine and ipecacuanha lozenges of the B.P. are very convenient for the slighter attacks of cough with throat irritability. In most cases of advanced phthisis we shall be compelled to have recourse, at times, to the preparations of opium, or morphine, or heroin to allay the cough.

"In advanced phthisis," says the late Dr. Thaon, of Nice, "the results obtained from morphine are so constant and so striking that I do not hesitate to formulate the following proposition, viz.: *where in a case of phthisis we have exhausted the whole materia medica, we have still a resource left in morphine.*"

The following formulæ for cough syrups will be found useful :—

℞ Morphinæ acetatis liquoris...	āā ʒij.
Aquæ laurocerasi	
Syrupi limonis	℥ss.
Aquæ chloroformi ... ... ad	℥jss.

Misce, fiat syrupus. Dose, a teaspoonful.

℞ Acidi hydrocyanici diluti	āā ♏ xxxvj.
Tincturæ belladonnæ	
Extracti opii liquidi	♏ lx.
Syrupi limonis	℥ss.
Mucilaginis acaciæ ... ... ad	℥jss.

Misce, fiat syrupus. Dose, a teaspoonful.

When an asthmatic tendency or predisposition is associated with phthisis, opium cigarettes, or stramonium cigarettes, the Cigarettes de Joy or d'Espic, will be found useful remedies for the night-cough.

In all cases in which the cough is associated with profuse expectoration from co-existing chronic catarrh of the air-passages we should endeavour to diminish the amount of this secretion; for this purpose inhalations of creasote, of tar, of oleum pini sylvestris, of terebene, of spirits of turpentine are useful, and so especially is rubbing the chest night and morning with the turpentine liniment of the B.P.

The combinations of *heroin* and *terpine hydrate*, now so largely prescribed, are very serviceable in these cases. Nervous, irritable patients should be encouraged to resist the desire to cough as much as possible, and it will often be found that some simple gum and fruit juice lozenge is all that is needed to allay the cough.

Vomiting after taking food is a very troublesome incident which most patients with chronic phthisis complain of more or less. Soon after taking a meal, or even during it, an attack of cough comes on, the paroxysms increasing in severity until a considerable quantity of mucus is brought up, and with it the contents of the stomach. The nature of this cough has been to some extent misunderstood. It has been referred to irritation of the gastric portion of the vagus by the contact of food (Peter), and as due to a state of special irritability of the gastric mucous membrane, and therefore the remedy prescribed is to give a rapidly absorbable sedative just before taking food, such as a few drops of laudanum in a teaspoonful of water, and immediately after the meal three drops of hydrochloric acid in water.

Another view of the cause of this incident assumes that it occurs chiefly in the more indurative forms and stages of this disease, and that it is due "to the mechanical difficulty in expelling secretions from cavities and bronchial tubes, which are surrounded by dense, tough, airless consolidations" (Powell). Both these explanations, partially true as they may be, leave out of sight a very simple and obvious contributory cause. It must be remembered that, with many of these patients, the upper air-passages are in a catarrhal state, and pour out secretion profusely on any excitement. Now even in cases of simple laryngeal catarrh, as most persons have experienced, upon taking a meal, although the cough may have been absent for some time, the secretion of mucus is augmented, and coughing recommences. It is clear that on taking food and drink there is a direct stimulus given to the circulation, and by rapid absorption of fluid the quantity of fluid in the blood-vessels is rapidly increased. This soon leads to increased secretion in the catarrhally affected air-passages, and this fresh secretion, added to what had already accumulated before food, causes a blocking up of the air-passages, and so leads to repeated and long-continued efforts of coughing to get rid of the accumulation, and at last, in the final violent contractions of the diaphragm and abdominal muscles, the contents of the stomach are expelled, mixed, as we have again and again seen, with great quantities of bronchial mucus. It is also a noticeable feature that the vomiting in these cases is rarely preceded or accompanied by any nausea ; it seems purely mechanical. Indeed, when vomiting after food is associated with nausea we regard this fact as indicating the existence of a morbid condition of the gastric mucous membrane, and treat the case accordingly.

Acting upon these considerations, we are in the habit of treating those patients who complain of severe paroxysms of cough, with vomiting, after or during meals, in the following manner :—Our object is to promote free expectoration, and so clear the air-passages immediately before the ingestion of food, and thereby postpone the cough after food until the stomach has had time to digest the chief part of its contents. In order to do this the patient is ordered a small quantity of warm, stimulating drink about half an hour before a meal, and is directed to encourage rather than suppress cough, so as to get up as much expectoration as possible before he sits down to his food. A tumblerful of equal parts of hot milk and seltzer or Ems water with a tablespoonful of brandy or whisky answers well, and will usually cause a good deal of expectoration. If milk is objected to, a cupful of beef-tea or chicken-broth with a tablespoonful of brandy may be taken instead. A few deep inhalations of some stimulating vapour such as that of creasote, pinol, terebene, or sanitas oil, obtained by pouring a few drops on the surface of boiling water, will greatly aid the object in view, namely, the expulsion of all the secretion possible *before* the meal is begun. Then let there be taken at the meal *as little fluid as possible*, and give ten grains of pepsin with ten drops of dilute hydrochloric acid, in water, immediately after it.

If, however, we have reason to believe that gastric irritability is a factor in the process, then we can give some preparation of bismuth with three or four drops of dilute hydrocyanic acid, a short time before a meal. Schacht's "Bisedia" is a fluid of this kind containing bismuth with pepsine, hydrocyanic acid, and morphine (gr. $\frac{1}{24}$ in a dram). In other cases, benefit sometimes results from giving 5 minims of liquor strychninæ an hour before food. The management of true dyspeptic conditions will be considered presently.

Next as to the treatment of **hæmoptysis.**

It is not easy to estimate accurately the precise value of any particular remedy that has been used for the relief of this symptom. The advocates of the open-air treatment maintain that it is remarkably infrequent in patients so treated. There are attacks of hæmoptysis which are almost immediately and of necessity fatal, as for instance many of those in the later stages of phthisis, dependent on the sudden rupture of an aneurysmal dilatation of a branch of the pulmonary artery of considerable size coursing along the walls, or stretching across a large vomica. No medicine can be relied upon to stop bleeding of this kind. On the other hand, there are attacks of hæmoptysis, for the most part congestive, occurring at long intervals, and limited perhaps to a single, more or less considerable gush of blood, followed by expectoration of blood for a short time, *i.e.* as long as extravasated blood remains in the air-passages; these require chiefly precautionary treatment to avoid recurrence. But even more protracted attacks tend, in favourable circumstances, to cease of themselves; it is not easy, therefore, when they do cease, to estimate with accuracy the precise share our treatment has had in producing this result.

It is also by no means a rare occurrence to observe a decided improvement in the physical signs and a notable arrest of the progress of the tubercular infiltration after a more or less copious hæmorrhage.

"Nothing," says Pidoux,* "is so certain to cease of itself, after a given time, as hæmoptysis, provided we do no more than protect the patient from all injurious influences"; and of the febrile forms he adds: "they follow their course, and end without being influenced, notably, by the most energetic remedies." "There are certainly cases in which a certain amount of hæmoptysis is more useful than injurious; it produces a notable diminution in the rapidity of progress of the tuberculisation." It is not, therefore, advisable in *all* cases, and especially in the congestive febrile forms, to be overanxious to arrest the bleeding. But in every case it is of the greatest importance to give the patient and his friends confidence as to the result being favourable. Remember that there is rarely any immediate danger, and that, when there is, our art is often of little avail. Always, however, do something! There is nothing that calms and allays anxiety in the minds of patients and their friends so much, in these alarming circumstances, as being given *something to do.* We should remember how much the capillary circulation is under the influence of the emotions in some subjects, and therefore a suitable mental impression may have a distinct physical effect on the peripheral vessels, and so aid in suppressing hæmorrhage.

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* "Études Générales et Pratiques sur la Phtisie" (second edition).

In the reports which patients bring us of loss of blood from the lungs we must be prepared for much exaggeration.

Active treatment is not required in slight cases; we should see that the bowels are regulated by a mild aloetic pill, or a few doses of the aperient sulphates, as free relief of the bowels is attended by a reduction of blood pressure. The food should be cold, light, and simple, and absolute rest for a time should be enforced. If blood-stained expectoration continues, and if the mucus is thick and tenacious, and expelled with difficulty, we should prescribe 3 or 4 ounces of warm Ems water twice a day; if it is thin and abundant, we should order 10 to 20 minims of dilute sulphuric acid, with $\frac{1}{12}$th of a grain of morphine or $\frac{1}{24}$th of a grain of heroin in a little syrup and water twice or thrice daily.

A large sudden gush of blood from the lungs may usually be regarded as due to the ulcerative erosion of a vessel of some size before it has had time to become obliterated, and this form may be encountered comparatively early in the course of rapidly progressing disease; while in advanced cavity cases it may be referred to the rupture of an aneurysmal dilatation of a branch of the pulmonary artery in the wall of a cavity; but serious hæmorrhages, and perhaps more protracted ones, will arise from congestion of the bronchial mucous membrane, or the lung substance itself, in the vicinity of advancing tubercular deposition, and those capillary hæmorrhages due to local hyperæmia are, probably, the most readily amenable to treatment.*

Protracted, or more or less continuous slow hæmoptysis, is not unfrequently encountered when, in debilitated or dissipated persons, phthisis attacks lungs which are, probably, already the seat of degenerative emphysema. This form of hæmoptysis is, so far as our own experience has extended, exceedingly difficult to arrest.

There are certain general rules which apply to the treatment of *all* cases of hæmoptysis. These are to keep the patient perfectly quiet in bed in the semi-recumbent position; to forbid all conversation and all mental excitement; to keep the apartment cool and airy, to allow only cold light food and cold iced drinks.

Of the various remedies advocated for the treatment of hæmoptysis, *ergot*, *ergotine*, and *ergotinine* formerly held a prominent place. Now the preparations of ergot are greatly discredited, as they are known to raise the pulmonary blood pressure.

Gallic acid used to be regarded as a valuable remedy for controlling and arresting pulmonary hæmorrhage; but it is now thought to have little or no astringent action.

Turpentine is undoubtedly a valuable remedy in troublesome forms of pulmonary hæmorrhage. It may be given in capsules, each containing 5 minims, every half hour until six doses have been taken; or it may be given, in from 5- to 20-minim doses, made into an emulsion with mucilage, or yoke of egg and syrup, three or four times a day.

Sulphuric acid, in the less severe and less urgent attacks, is an excellent remedy, and it is well, when there is no counter-indication, to combine it with a saline purgative like sulphate of magnesia to lower general blood pressure, and if there is some feverishness, as there often is, some quinine—as in the following prescription :—

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* The pulmonary congestion to which these hæmorrhages are due have recently been referred to the influence of infective organisms, especially the pneumococcus and pus-producing bacteria.

℞ Acidi sulphurici aromatici	♏xv.
Magnesii sulphatis	ʒj.
Quininæ sulphatis	gr. j.
Aquæ	ad ℥j.

Misce, fiat haustus. To be taken every three or four hours. Alum, 5 to 10 grains may be added to each dose of this mixture.

Perchloride of iron is a useful remedy in some cases, especially in apyretic anæmic forms. It should be given in 10- to 20-minim doses, with a little syrup and water, every two or three hours.

Some divergence of opinion exists as to the propriety of administering *digitalis* in hæmoptysis, as it usually increases the blood pressure, but against this we must set its valuable influence in allaying cardiac excitement, and the weight of authority is in favour of its use in certain forms of hæmoptysis. Ringer recommends the infusion in large doses. "When it quiets the pulse," he says, "the bleeding ceases." Hertz advises its use when the action of the heart is very excited. Pidoux counsels digitalis in large doses in the febrile forms of hæmoptysis.

It may therefore be accepted that digitalis is a valuable addition to other remedies when we desire to regulate and quiet excited action of the heart in cases of hæmoptysis. *Aconite*, minim doses of the tincture every hour, for 4 or 5 doses, is of value when we desire to lower pulmonary blood pressure.

Adrenalin chloride, strongly advocated by some, is as strongly objected to by others on account of its tendency to raise the blood pressure. We must remember that there is a sort of fashion existing at present to make use of this drug! This remark applies also to another drug, *calcium chloride*. This has been advocated for the arrest of hæmorrhage on account of its property of increasing the coagulability of the blood.

Gelatine has been prescribed for the same reason, either in the form of jelly by the mouth or hypodermically. Some physicians think well of the use of nitro-glycerine or inhalations of nitrite of amyl to lower blood pressure.

Acetate of lead was, at one time, largely employed as a remedy for hæmoptysis, but it is less frequently used now. Its action is too slow for urgent cases, and its constipating effect makes it an inappropriate remedy in the more chronic forms of slow continued bleeding.

Common salt is an old remedy for hæmoptysis, and salt and water used often to be given by the nurses of the Brompton Hospital as an extemporary measure. Hertz considers it an efficacious expedient given in doses of a half or a whole tablespoonful, either dry or mixed with a little water.

Ipecacuanha in nauseating and emetic doses was strongly advocated in the treatment of hæmoptysis by Trousseau, Peter, and other French physicians, and recently its use has been recommended by Dr. Philip, who gives 5-grain doses every hour or two. He says that "it is not necessary or desirable to produce emetic effects," but our experience is that these doses would certainly produce such effects in many patients. As to this mode of treatment, we are in agreement with Hertz,* that "the danger that new hæmorrhages may be produced by the jarring of the body during the act of vomiting is so apparent that this mode of treatment should meet with disapprobation, in spite of the high standing of its advocates."

Cold, applied locally, is no doubt a powerful agent in arresting some forms of hæmorrhage, especially the sudden and profuse attacks in advanced cavity cases. Cold wet compresses, cooled by placing them on ice, may be applied over the heart; in persons very sensitive to cold a piece of ice may be enclosed in a thin pocket-handkerchief and rapidly passed over the præcordium.

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* Ziemssen's "Cyclopædia of Practical Medicine," vol. v., p. 319.

The use of *opium* or morphine or codeina, in combination with whatever other remedy may be employed, is indicated in all cases of serious hæmoptysis. There exists some difference of opinion on this point, we know, but the testimony of most writers of authority and experience is in favour of this view. Not only is it urgently necessary to quiet the cough, for every effort at coughing alarms the patient, as it disturbs the bleeding vessel and is attended with fresh hæmorrhage, but the calming influence on the nervous and circulatory systems, and the lowering of blood pressure which opium and morphine exert, are also of great value.

The hæmoptysis of the *intemperate* who become the subjects of phthisis is often associated with a certain amount of venous congestion, and it is necessary in these cases to give *purgatives.* A combination of 1 dram of sulphate of magnesia with 15 minims of diluted sulphuric acid in an ounce of infusion of roses every three or four hours, and if necessary 1½ grains of extract of aloes in a pill, once a day, until we establish a free fluid discharge from the bowels, is the best treatment for such cases, which, however, generally do badly.

Blood-letting will rarely be an appropriate remedy in the hæmoptysis of phthisis, of whatever use it may be in other forms of pulmonary hæmorrhage, as for example in the passive hyperæmia, with tendency to stasis of blood in the lungs from heart disease; and in those rare cases in robust persons which have been attributed to sudden intense pulmonary hyperæmia.

The application of blisters should be reserved for those cases of obstinate continued bleeding dependent on congestive or inflammatory hyperæmia.

We must never overlook the value of aperients as depressors of vascular tension in suitable cases. The alkaline sulphates are the best.

With regard to the use of alcohol, some differences of opinion are encountered. It must be largely left to the wisdom and discretion of the medical attendant. Small quantities of iced brandy-and-water are certainly useful in some cases, and seem to have a good effect in steadying the action of the heart, in lessening the effect of nervous shock, and in preventing fatal syncope after large losses of blood.

If we happen to know from which lung the bleeding proceeds it is desirable to direct the patient to lie on that side, to prevent the blood flowing into and infecting the other lung; but we must remember that physical examinations are most undesirable in these cases.

There are, finally, certain *prophylactic* measures which should be enforced on persons who are phthisical, and who belong to the hæmorrhagic diathesis. It is well known how readily and from what slight causes such persons bleed. They should, therefore, avoid all exciting and fatiguing games and exercises; they should not take out-of-door walking exercise when there is a strong, cold wind blowing. They should avoid hot, exciting food, and such drinks as tea, coffee, wine, and spirits, except in very small quantities. It is, however, good for them to live much in the open air of the country. Mountain air is certainly not counter-indicated, but residence too close to the sea is often prejudicial.

Disorders of digestion.—Disturbances of digestion accompany some cases of phthisis from beginning to end, more or less gastric catarrh being almost invariably present. The constant recurrence of these gastric troubles is always of ill omen, and the phthisical patient who eats and digests well is already on the way to amendment or cure.

(1) Simple *loss of appetite* is one of the most common of these troubles. It is best remedied by an open-air life, by removing the patient from a close, confined town residence to the pure air of the country.

Where it depends on feeble tone of the stomach, this may often be roused and improved by vegetable bitters combined with small doses of sodium bicarbonate, given a short time before food. The best of the vegetable bitters are calumba, chirata, gentian, quassia, bitter orange-peel, quinine, and, perhaps, best of all, strychnine and nux vomica. Five to 10 minims of the tincture of nux vomica, with 10 grains of sodium bicarbonate and 20 minims of spirit of chloroform in an ounce of infusion of calumba, taken half an hour before meals, will often promote appetite.

When there appears to be no indication for alkalies, we sometimes succeed better by giving 3 to 5 minims of liquor strychninæ, combined with 15 minims of dilute hydrochloric or phosphoric acid in an ounce of infusion of orange-peel two hours before meals.

(2) Loss of appetite is in many cases associated with genuine *dyspepsia*, due either to the presence of gastric catarrh or to atony of the gastric functions, defective gastric secretion, etc. This catarrhal condition is often evidenced by retching in the morning, and the bringing up of stringy stomachal mucus, or quantities of a thin watery fluid (pyrosis).

Bismuth is one of the most efficacious remedies we possess for these catarrhal dyspepsias, and when there is a tendency to vomiting from irritability of the gastric mucous membrane, a small dose of opium may be combined with it. The following is a good formula—the mixture should be taken almost directly before food:—

℞	Bismuthi salicylatis	gr. x.
	Tincturæ opii	♏ij.
	Magnesii carbonatis	gr. v.
	Misturæ tragacanthæ	ʒij.
	Infusi aurantii	ad ℥j.

Misce, fiat dosis.

When there is much flatulent distension of the stomach and intestines during digestion very great benefit will often follow the administration of 1 minim of creasote mixed with a little glycerine and peppermint water immediately after a meal. While the alkalies prove so beneficial in some of those cases, when given *before* food, a dose of hydrochloric acid is often found of the greatest service, taken immediately *after* a meal. This is especially the case in the feeble atonic forms of dyspepsia, when there is clearly an insufficient or imperfect secretion of gastric juice; in such cases 10 to 15 minims of dilute hydrochloric acid in a little glycerine and water, with 10 grains of pepsine directly after food, may be taken.

(3) The *constipation* which attends some of these cases is best treated by an aloetic pill—1 to 2 grains of the watery extract of aloes, with ½ a grain of extract of nux vomica, and ½ a grain of powdered ipecacuanha; this pill should be taken at night, and the next morning it should be followed by a large teaspoonful of Carlsbad salts in half a tumblerful of hot water.

(4) The attacks of *gastralgia*, with obstinate vomiting, which occasionally occur in phthisical patients must be treated according to the rules laid down in a former chapter (Part I., Chap. VI.).

The occurrence of **diarrhœa** in the course of a case of phthisis will always excite the suspicion that it may be due to tubercular ulceration of the intestine. But we may have to deal with a diarrhœa from simple intestinal catarrh, or with one due to those digestive difficulties so commonly encountered in phthisical patients. The results of treatment will enlighten us on this point, and, as a rule, the presence of severe localised continued abdominal pain will point to the existence of tubercular ulceration. Something also may often be learnt from the examination of the stools, and we should be careful to see whether portions of hard irritating scybala are mixed with the loose motions, or whether they contain mucus, or mucus mixed with blood.

The occasional diarrhœa due to intestinal catarrh, or to the irritation of retained fæces, and the sequel of constipation, will be best treated by gentle aperients, at first; perhaps the best is a small dose (a teaspoonful) of castor oil the first thing in the morning, with two tablespoonfuls of hot milk, and a teaspoonful of brandy. This dose may be repeated if necessary. If some catarrhal diarrhœa still remains it will usually yield rapidly to a few doses of bismuth carbonate (10 grains), with sodium bicarbonate (5 grains), and compound kino powder (5 grains). Soft unirritating farinaceous foods should at the same time be prescribed.

If the diarrhœa is associated with a great deal of flatulent distension, and the passage per anum of fœtid gases, 1 minim of creasote shaken up with a tablespoonful of lime water should be given immediately before each meal, or 10 grains of salicylate of bismuth may be given instead.

Amongst other remedies for the diarrhœa of the phthisical not dependent on intestinal ulceration, perhaps none is more generally useful than *lime water*, given in ounce doses, with an equal quantity of milk, several times a day; or we may use the *liquor calcis saccharatus* in doses of 30 to 60 minims. *Bismuthi subgallas*, which has been greatly praised, is given in doses of 10 to 30 grains in the day.

In cases where there is much pain accompanying the diarrhœa, whether it is due to intestinal ulceration or not, we shall have to employ opium in some form, and it is undoubtedly better to give it by the rectum than by the stomach; a small enema consisting of 5 or 10 grains of Dover's powder (or 5 to 10 minims of laudanum), and 5 or 10 grains of tannin mixed with two ounces of starch mucilage, and injected into the rectum twice a day, will be found a very efficacious remedy; or we may use the suppositories of acetate of lead and opium (B.P.), but these are slower in their action; or a hot flannel sprinkled with laudanum may be placed over the abdomen.

The diarrhœa attending advanced tubercular ulceration is notoriously difficult of arrest; besides the means suggested above, we have found pills containing nitrate of silver ¼ to ½ a grain, and opium ½ grain, given three times a day, of great service when other remedies have failed. Sulphate of copper given in the same way has been found useful. In advanced cases we have found the *extract of coto bark* very efficacious. We give it in the following form :—

Fluid extract of coto, 60 minims.
Compound tincture of cardamoms, 60 minims.
Mix these together and triturate them slowly with mucilage of acacia 3 drams, and simple syrup 2 drams.
Finally add water to 6 oz.
A tablespoonful of this mixture is a dose.

In this form it is an opaque mixture, with a not unpleasantly warm and aromatic taste. We have often found two or three doses of the mixture arrest or check severe forms of phthisical diarrhœa.

ADDITIONAL FORMULÆ

For the pyrexia of phthisis

℞ Quininæ hydrochloridi, gr. xv.
Sodii salicylatis, ʒss.
Sodii bicarbonatis, gr. xlv.

M. et divide in pulv. x. A powder twice or thrice a day.
(*Schnitzler.*)

For the fever of phthisis

℞ Quininæ sulphatis, gr. xxiv.
Pulveris digitalis, gr. xij.
Pulveris ipecacuanhæ, gr. vj.
Pulveris opii, gr. vj.
Extracti glycyrrhizæ, q.s.

Ut f. pil. xxiv. One three times a day. (*Heim.*)

For subfebrile states in phthisis

℞ Potassii bicarbonatis, ʒvj.
Liquoris morphinæ hydrochloridi, ʒj.
Aquæ laurocerasi, ʒij.
Aquæ destillatæ ad ℥viij.

M. f. mist. A large tablespoonful with as much fresh lemon-juice every four hours whilst effervescing. (*Whitla.*)

For hæmoptysis

℞ Ergotini, ʒss.
Morphinæ hydrochloratis, gr. jss.

M. et divide in pil. x. One three times a day. (*Schnitzler.*)

For the same

℞ Spiritus terebinthinæ, ʒjss.
Olei amygdalæ dulcis, ʒjss.
Mucilaginis acaciæ, ʒv.
Syrupi simplicis, ʒv.
M. et adde
Aquæ ad ℥viij.

F. emulsio. A tablespoonful every half hour. (*Bamberger.*)

For the night sweats

Salicylic acid, 2½ drams.
Venetian talc, 6 oz.
Starch powder, 6 oz.
Iris powder, 5 drams.

To be applied to the surface.
(*Bamberger.*)

For the same

℞ Agaricini, gr. jss.
Pulveris ipecacuanhæ compositæ, gr. xx.
Pulveris althææ, q.s.
Mucilaginis acaciæ, q.s.

Ut f. pil. xx. One or two at night.

(*Bamberger.*)

For the same

℞ Zinci oxidi, gr. iijss
Extracti belladonnæ, gr. $\frac{1}{8}$.
Extracti hyoscyami, gr. ijss.

M. f. pil. At bed-time.

(*Whitla.*)

For diarrhœa of phthisis

℞ Extracti opii, gr. jss.
Syrupi aurantii, ʒv.
Infusi calumbæ ad ℥v.

M. f. mist. A tablespoonful every two hours.

For hæmoptysis with cough

℞ Extr. fluid. hydrastis canadensis, Tinct. hydrastis canadensis āā ℥ss.
Codeinæ, gr. vi.

M. f. mist. Twenty to fifty drops three times a day.

(*Scarpa.*)

Or

℞ Bismuthi subnitratis, ʒss.
Extracti opii aquosi, gr. iij.

M. et divide in pil. x. One every two or three hours.

(*Schnitzler.*)

CHAPTER VI

TREATMENT OF COMPLICATIONS OF PHTHISIS

Treatment of Laryngeal Phthisis: Vocal Rest—Inhalations, Solvent, Disinfecting, Astringent, Emollient—Applications of Iodine and Carbolic Acid—Borax and Glycerine—Iodoform and Morphine — Orthoform — Cocaine — Menthol — Lactic Acid — Formalin — Intratracheal Injections — Chloroform Inhalations. *Treatment of Pleuritis:* Anodyne Liniments—Blisters—Iodine—Paquelin's Cautery—Strapping the Chest—Treatment of Effusions. *Pneumothorax and Pyopneumothorax*—Opium and Stimulants—Introduction of Capillary Trocar—Indications and Counter-indications for Operation. *Fistula in ano*: Considerations for and against Operation. List of Sanatoria for Phthisical Patients.

THE only complications of phthisis the treatment of which it is necessary to consider here in detail are the following:—

1. Affections of the larynx and laryngeal tuberculosis. 2. Pleuritis. 3. Pneumothorax and pyopneumothorax. 4. Fistula in ano.

1. **Laryngeal phthisis.**—The distressing laryngeal affections which frequently occur in the course of phthisis may assume various degrees of severity, from simple catarrhal conditions to necrosis and exfoliation of cartilages and diffusion of tuberculous deposit through the mucous and submucous tissues; morbid conditions in which we are compelled to have recourse mainly to topical treatment. But recently much attention has been given to the effect of *complete vocal rest* in *sanatoria* in the treatment of laryngeal tuberculosis. Sir Felix Semon* and many other physicians have borne testimony to the great value of this method. The method is a new one only so

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* *British Medical Journal*, Dec. 8th, 1906.

far as *sanatorium* treatment is concerned, for Moritz Schmidt, of Frankfort, in 1887 noted that after tracheotomy the tubercular disease often disappeared without further treatment, a result he referred to *quiescence of the larynx*. It is scarcely possible to secure complete and continuous rest of the larynx, by means of absolute silence maintained for long periods, except in a sanatorium, and even in such an institution it requires a strong effort on the part of the patient to resist all temptations to conversation. This method, besides securing perfect rest to the vocal organs, leads to the avoidance of such irritants to the air passages as dust, tobacco, unsuitable foods and drinks, etc., when carried out in a well-conducted sanatorium. It is not intended, as Sir F. Semon remarks, to do away with local treatment altogether, and a combination of both methods in the more severe cases will often produce excellent results.

In the catarrhal conditions, when *acute* or *subacute*, and when the laryngeal mucous membrane is covered with copious secretion from the bronchi and lungs, we should employ free irrigation by means of sprays of solvent and disinfecting solutions—such as Ems water, solutions of sal ammoniac, or common salt or borax (1 to 5 per cent.). When the larynx is very irritable, and even inhalation of Ems water, or weak solutions of common salt, cannot be borne, we must have recourse to emollient vapours and fluids such as the steam or spray of hot water, or of hot infusions of marsh mallow or of elder flowers, to any of which a little glycerine may be added, or a little ipecacuanha wine, together with a few drops of laudanum.

In more *chronic* catarrhal conditions, with considerable swelling of the laryngeal mucous membrane, it has been recommended (Solis Cohen) that the tumefied portions of the mucous membrane should be well painted every two or three days with a weak solution of iodine and carbolic acid, and the parts kept as free as possible from accumulated secretions by the use of an alkaline solvent inhalation, such as

5 grains of borax, 1 dram of glycerine, and 7 drams of tar water.

When **ulceration** occurs, and painful inflammatory symptoms accompany the ulcerations, and when, owing to the situation of the ulcers, they are exposed to mechanical irritation during swallowing, we encounter a condition often extremely difficult to alleviate. The insufflation of *iodoform* and *morphine* in powder (iodoform gr. iv, morphinæ acetatis gr. $\frac{1}{4}$, bismuthi subnitratis gr. ii) is one of the best remedies for this state, but it is important that the ulcerated surface should first be thoroughly cleansed by an alkaline spray so that the powder may reach the diseased surface, and not be simply entangled in the secretions covering it. *Orthoform*, which has both anæsthetic and antiseptic properties, has been largely used as an insufflation alone or combined with iodoform (iodoform gr. iv, orthoform gr. vj), or in solution as a spray (orthoform gr. v, spr. vini rect. and aquæ āā ℥j). A great advantage attending its use is that the anæsthesia it produces lasts a long time—24 hours or longer. It, however, only acts on an ulcerated surface.

For the dysphagia we have another valuable resource in the application to the parts exposed to irritation of a 10 per cent. *solution of cocaine*, or eucaine, or the spray of a 2 to 4 per cent. solution may be applied to the larynx shortly before taking food. In very severe cases we may accompany the local application of cocaine with the hypodermic injection of $\frac{1}{6}$th to $\frac{1}{3}$rd of a grain of morphine, and in most of these cases it will be advantageous to administer some part at least of the food by rectal injection.

Menthol has been found very useful in some of these cases. It is mixed with sweet almond oil (1 in 5), and applied by means of a mop of cotton-wool, or an endo-laryngeal syringe, or it may be combined with cocaine in an oily spray (menthol gr. xx ad xl, cocainæ gr. v, ol. vaselini ℥j; M.).

Of agents for destroying the tubercular deposit, *lactic acid* is the most popular. It is usual to begin with weak solutions (5 per cent.), and to increase the strength to perhaps 40 per cent. if well tolerated. These and similar solutions are best applied with a mop of cotton-wool, not too wet, lest a drop of the solution should fall into the trachea and set up spasm of the glottis.

It is necessary also previously to apply an anæsthetic, such as a 10 per cent. solution of cocaine. Amongst other drugs used instead of lactic acid we may mention sulphoricinate of phenol, para-monochlorphenol, and formalin.

Formalin has many advocates. It is applied in a 1 to 10 per cent. solution of the commercial product.

Intratracheal injections of antiseptic substances mixed with a mineral oil have been extensively used in these cases. The following is a suitable formula: —Guaiacol and naphtholine, of each 2 per cent., parolein 96 per cent. About ½ an oz. is injected by means of a special syringe at a temperature of 80° to 90° F. The patient is told to inspire deeply directly the injection has been made, and to resist coughing as long as he can.

When these measures fail, operative procedures are often resorted to, such as curetting, cutting, and punching-out, and, in cases in which the epiglottis is extensively diseased, entire excision of this organ by the galvano-cautery snare has been strongly advocated.

The *food* of such patients should be bland and unirritating, and *semi-solids* are better taken than liquids by many. Custards, jellies, junket, pounded meat, or chicken, and especially finely minced raw beef mixed with yolk of egg, are suitable, and the last has been found very serviceable.

The wearing of such an inhalation-respirator, made of perforated zinc, as we have already described (*see* p. 581, vol. i.), charged with terebene, creasote, carbolic acid, or eucalyptol, will, as Dr. Solis Cohen observes, be useful "for antiseptic, astringent, and slightly stimulating purposes," and when an equal quantity of chloroform is mixed with either of these substances, a few drops inhaled from the sponge of the respirator will often relieve the harassing cough of this painful affection better than any other remedy; or ethyl iodide may be used in the same way.

As we have already said, for the severe dysphagia, insufflations of morphine, or orthoform, or the application of a 5 to 10 per cent. solution of cocaine or eucaine may be tried, but we must not withhold from the patient who is suffering otherwise irremediable distress, in an advanced stage of this afflicting malady, the temporary comfort of a hypodermic injection of morphine or the inhalation of 30 or 40 minims of chloroform.

2. **Pleuritis.**—Some inflammatory affection of the pleura is almost certain to be encountered during some period of the progress of a case of phthisis. This is usually due to attacks of dry pleurisy, and is often attended with a good deal of *pain*, aggravated by breathing, coughing, etc. Apart, however, from these attacks of pleuritis, phthisical patients occasionally appear to suffer a good deal from what seem to be *painful affections* of the *intercostal nerves and muscles.* These latter painful conditions of the chest wall are best relieved by friction with a liniment composed of equal parts of the belladonna and chloroform liniments of the B.P.; or a belladonna or opium plaster will assuage the more strictly circumscribed pains.

The pleuritic affections of the upper part of the chest, where they are most frequently encountered, are generally relieved by counter-irritation, especially in the form of flying blisters, or iodine paint frequently re-applied, or the application of Paquelin's cautery. When these attacks occur at the base of the chest, it is as well to fix the side of the chest affected as immovably as possible for a time, by means of broad strips of adhesive plaster 4 or 5 inches wide and extending from 2 or 3 inches beyond the spine behind and to the same distance beyond the median line in front. By this means the patient will be spared much of the distressing pain attending cough and inspiration, and by the enforced rest of the part affected the risk of extension of the inflammation will be lessened, or if there is risk of perforation of the pleura pulmonalis from the softening of some superficial deposit, that risk also will be diminished by this measure. If the pressure of strapping cannot be borne, relief of the pain may often be obtained by the application of a hot flannel sprinkled with laudanum.

Now and then in the course of a case of phthisis we encounter a large fluid effusion into one or other pleural cavity. How should such a complication be treated? At first, at any rate, the patient should be confined to his bed, and his diet carefully regulated, his bowels kept open, and, if there is any considerable amount of fever, some quinine (2 to 3 grains) should be given him in an effervescing saline draught every five or six hours. Should the fluid, whether serous or purulent, be removed by aspiration? We are strongly of opinion that it should not, unless its amount is so considerable that grave dyspnœa is caused by it, and then only a small portion should be removed to relieve this symptom. It will often be observed, in one-sided phthisis, if a considerable pleuritic effusion occurs, so as to compress the lung completely on that side, the progress of the disease in the lung is by that means arrested, and remains quiescent so long as the lung remains compressed by the effused fluid; but if a too zealous physician removes the fluid by aspiration the disease in the lung will usually be found to progress rapidly after the operation.

It is, therefore, in our opinion the best practice to leave pleuritic effusions in phthisical patients alone, unless urgent dyspnœa, or other adequate motive, should necessitate their partial removal.*

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* Refer to what is said of Sir J. Barr's method of treating pleural effusions by the injection of sterilised air and adrenalin solution, vol. i., p. 700.

3. **Pneumothorax and pyopneumothorax.**—The pain, dyspnœa, and shock which attend sudden perforation of the lung, and the development of pneumothorax in the subjects of phthisis, are best treated by the administration of stimulants and opium. A tablespoonful of brandy, with a little water, or a dose of ammonia and ether mixture every hour for a few hours may be given, and to the latter five to ten drops of tincture of opium may be added ; or if the pain and dyspnœa are very severe, a hypodermic injection of $\frac{1}{6}$th of a grain of morphine may be immediately given, and repeated after an hour if necessary.

It is scarcely ever necessary in cases of phthisis to resort to blood-letting in order to relieve the sudden hyperæmia of the uncompressed lung ; this may be needed in some traumatic cases, but in most patients with phthisis who become the subjects of this complication there has been for some time slow wasting of blood, and therefore excessive hyperæmia of the unaffected lung is little to be feared. Free dry-cupping over the sound side is, however, a desirable expedient for relieving the engorgement of that lung.

The patient should be kept perfectly quiet, and not allowed to talk ; the diet should consist of light, easily digested food, and an effervescing dose of citrate of potash and ammonia, to which a grain or two of quinine may be added, should be given occasionally to check the tendency to febrile reaction.

A regular action of the bowels should be secured by means of enemata if necessary, or an aloes and soap pill may be given daily. By preventing constipation—which opium, if given, is likely to produce—we avoid a further cause of dyspnœa from the upward pressure of the retained intestinal contents on the diaphragm.

When there arise evidences of considerable pressure within the thorax, such as increasing dyspnœa, and great displacement of the heart and surrounding organs, the tension of the air within the pleura must be relieved by the introduction of a capillary trocar and cannula, an operation which is perfectly harmless, and often attended by great relief of immediate distress. It is obvious that this expedient will fail to give relief unless the perforation of the lung is closed, and it is impossible to ascertain this beforehand; usually, however, when the opening is small it closes in three or four days; the trocar is usually introduced between the fourth and fifth ribs, somewhat externally to the mammary line. This must, of course, be done with antiseptic precautions. If necessary the cannula may be retained in the chest, its opening being covered by a piece of gold-beater's skin. When it is withdrawn the small wound made should be closed with a strip of adhesive plaster, or covered with collodion. Some apply a small ice-bladder to the seat of the puncture for twenty-four hours.

If violent cough should come on (as it sometimes does) during the withdrawal of air from the pleural cavity, it must be quieted by hypodermic injection of morphine, or the trocar may be removed and the opening compressed for a time until the irritative cough has disappeared. If this precaution be disregarded it has occasionally happened that distressing general emphysema has been suddenly induced from the air violently expelled, during cough, from the pleural cavity, entering the subcutaneous areolar tissue around the punctured opening.

Before long *suppurative pleuritis* follows the pulmonary perforation, and the pneumothorax is converted into a *pyopneumothorax*. We must be very careful, here, as in the case of serous effusion, how we interfere for the purpose of removing it.

When the other lung has been sound it has, occasionally, been observed that the occurrence of pneumothorax and consequent empyema has, by compressing the diseased lung, arrested the progress of the disease in it, and patients have been observed to live for many years with pyopneumothorax. In such cases purulent absorption is avoided by the pleural cavity becoming lined with a thick pyogenic membrane, and so suppurative fever is prevented; whereas, these patients often sink rapidly after free opening of the pleural cavity has been made to give exit to the accumulated pus. Operative interference for the removal of the effusion is only warranted when this is of such an amount that it gives rise to serious dyspnœa and dangerous displacement of the heart and surrounding organs. Aspiration may then be necessary, and this operation may have to be repeated. If this is unsuccessful, Mr. Godlee has described a method of draining and washing out the pleural cavity with an antiseptic fluid.*

If there are much pain and fever excited by the secondary pleurisy, linseed poultices sprinkled with laudanum may be applied locally, moderate doses of quinine should be given in an effervescing saline draught, and hypodermic injections of morphine, or opium by the mouth, will be required to relieve the pain and distress of the patient. Later on, should there be evidence of decomposition of the effusion, with symptoms of infective fever, operation may be needed.

4. **Fistula in ano.**—The only question that has to be considered with regard to the treatment of fistula in ano when it occurs as a complication of phthisis, is whether or not it should be operated upon. Surgeons certainly are averse from performing this operation in cases of undoubted phthisis. It has been suggested as a reason, not against operation, but against *curing* the fistula, that it acts as a useful derivative to the pulmonary lesions, and some believe they have observed a kind of alternation in the activity of the fistula and the pulmonary affection.

We are disposed to regard this as more fancied than real, and to believe that if the fistula could be cured, without other risk than this, it would be altogether a gain to the patient, and save him much inconvenience and pain, and remove a cause of debility and exhaustion. But what would chiefly influence our opinion would be the general constitutional condition of the patient and the stage of his pulmonary disease, because the feverish and debilitated state in which the majority of phthisical patients are found would interfere greatly with the success of the operation, and prevent healthy cicatrisation, and this would be an all-sufficient reason for objecting to surgical interference. But if the pulmonary affection is quiescent, and the patient is otherwise in sound health, and leading a healthful life, and of average vigour, and is himself anxious to be relieved of the annoyance, we should not ourselves be disposed to offer any opposition to the operation. Another valid objection to the operation would be the possible tuberculisation of the tissues around the fistula, which would present an obstacle to healthy healing, and this possibility ought to be duly considered.

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* *See* Fowler and Godlee's "Diseases of the Lungs," p. 643.

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* An "English" Sanatorium with an English doctor is now available at Leysin, in addition to the three other sanatoria already existing there. The terms are 9 francs a day. Elevation nearly 5,000 feet.

PART V.—DISEASES OF THE LIVER

CHAPTER I

TREATMENT OF GALL-STONES (CHOLELITHIASIS)

Frequency of Biliary Concretions in the Gall-bladder—Their Origin—Composition—Characters and Structure—Etiology—Bacillary Infection—The Neurotic Constitution—Changes in the Composition of the Bile—Catarrh of Bile Ducts—Influence of Food Habits—Want of Exercise—The Gouty Diathesis—Corpulence—Age—Female Sex—Pregnancy—Tight-lacing. *Symptoms*—Attacks of Biliary Colic—Pain—Rigors—Rise of Temperature—Vomiting. *Indications for Treatment.* 1st. *During the Crises*—Hypodermic Injection of Morphine and Atropine—Opium by the Stomach—Chloroform Inhalation—Local Applications, Fomentations, and Poultices—Copious Warm Alkaline Drinks—Belladonna and Podophyllin—Leeches—Ether, Ammonia and Brandy for Collapse—Ice to allay Vomiting—Turpentine. 2nd. *During the Intervals.*—Manipulation of the Gall-bladder—Olive Oil in large doses—Aperients—Warm Alkaline Drinks—Cholagogues—Courses of Mineral Waters, Carlsbad, Vichy, etc.—Sodium Salicylate—Diet and Regimen. Indications for Surgical Interference—The Operations: (1) Sounding, (2) Aspiration, (3) Choledochotomy, (4) Cholelithotrity, (5) Cholecystostomy, (6) Cholecystotomy, (7) Cholecystectomy, (8) Cholecystenterostomy. Additional Formulæ.

IN reviewing **diseases of the liver** from the standpoint of clinical therapeutics we are compelled to set aside certain of these affections as either wholly uninfluenced by treatment, as for instance that rare malady, *acute yellow atrophy*, or as presenting only *general symptomatic* indications, as cancerous, sarcomatous, or other new growths in the liver, or as simply forming part of a general constitutional morbid state, as the *amyloid liver* and the *fatty liver*.

The morbid states associated with the liver which chiefly concern us in this and the following chapters are—1. *Gall-stones* or *cholelithiasis*. 2. Certain forms of *jaundice*. 3. *Hyperæmic states* or *congestions.* 4. *Acute and chronic inflammations; abscess; cirrhosis.* 5. *Hydatid cysts.*

Biliary calculi are of common occurrence in the gall-bladder, and these concretions are often found in that organ in considerable numbers, after death, without having given rise to any symptoms during life dependent on their presence there. Single concretions, large enough to fill the whole cavity of the gall-bladder and moulded to its shape, are sometimes found. These large biliary concretions occasionally ulcerate their way through the coats of the gall-bladder into the intestine (to which the gall-bladder has, previously, become adherent), and they may then be evacuated by the bowel, or may lead to symptoms of intestinal obstruction. Sometimes gall-stones ulcerate through the gall-bladder into the peritoneal cavity and set up diffuse peritonitis, which may prove fatal. Sometimes adhesions form between the gall-bladder and the abdominal wall, and external fistulæ are formed, through which these concretions are expelled. We have ourselves recorded a case in which numerous gall-stones had passed out of the gall-bladder and become infiltrated into the abdominal wall, and a great number of these were removed from the sinuses they occupied by Lord Lister.

But the symptoms dependent on *gall-stones* which usually call for medical treatment are those caused not so much by the existence of those concretions in the gall-bladder, as by the passage of one or more of them along the cystic and common bile ducts into the small intestine. So long as these concretions remain quietly in the gall-bladder they may give rise to no symptoms whatever, and, indeed, they occasionally pass through the bile duct into the intestine and out of the body without causing any symptom, especially when they are small, or when, possibly, the duct is abnormally large, or has become distended by the previous passage of larger calculi. The symptoms which usually call our attention to the existence of gall-stones are either **pain** excited during the passage of the calculus along the cystic and common bile ducts, or **jaundice** from obstruction to the passage of the bile into the intestine by the blocking up of the common duct by the concretions, or, most commonly, both.

A few remarks as to the composition, origin, and symptoms of gall-stones will fitly precede a detailed consideration of the treatment they require.

Minute pigmentary calculi (bilirubin-calcium) may be formed in the bile channels in the liver: and these in turn may form a nucleus for deposit of cholesterin in the gall-bladder, or more rarely in the bile-ducts outside the liver. Biliary calculi of clinical significance are almost invariably formed in the gall-bladder. They vary greatly in size. As we have already said, a single stone may be large enough to fill the whole cavity of the gall-bladder; on the other hand, they are often so small as to be scarcely larger than grains of sand or small shot. These small, black, rough, irregular-shaped calculi are often spoken of as *biliary sand* or *gravel.* Between these extremes all degrees of size may be found. The smaller stones may be exceedingly numerous; as many as a thousand and upwards have been found in a single gall-bladder. The dark, smaller kinds are composed almost entirely of bile pigment; they are soft, and can easily be crushed to a coarse powder. The larger ones are composed chiefly of cholesterin mixed with bile pigment. When numerous they become facetted and angular from mutual contact and friction. Sometimes they are of soft consistency and are easily crushed; at other times they are hard and incapable of being crushed. Most commonly they have a yellowish-white or fawn-coloured surface, and on section they are seen to be composed of concentric layers with radiating lines; the pale superficial layers are usually succeeded by a dark band separating them from the deeper layers, which are mostly of a dark yellow or brown colour, due to bile pigment. Some lime salts (bilirubinate of lime) are found in the outer layer, but the majority of gall-stones contain 70 to 80 per cent.

of *cholesterin*, mixed with bile pigment. The central nucleus is usually formed of bile pigment, in combination with calcium. Catarrh of the bile-ducts liberates albumen into the bile, and in the presence of albumen bilirubin is precipitated in combination with calcium, which also is a constituent of the catarrhal exudate. The accretion of cholesterin takes place in the gall-bladder.

What are the **causes** which determine this precipitation of cholesterin and bilirubin chalk? This is a difficult question to answer, for the mode of origin of gall-stones is still somewhat obscure; their chief chemical constituents come from the mucous membrane of the gall-bladder and biliary ducts, and Naunyn asserts that *lithogenic* catarrhs of this mucous membrane may be of infectious origin and excited by microbes, of which the *bacillus coli* is the principal offender. Next to this, the typhoid bacillus is perhaps most often causally connected. Those whose virulence has been attenuated are most prone to excite lithogenic catarrhs: virulent infections set up acute cholecystitis. These slight infections may arise, whenever there is *stagnation of bile*. It does not happen when the bile flow is normal, and it is owing to disturbances in the flow and evacuation of the bile that biliary concretions form. The *bacillus coli*, which is almost always present in normal bile, may become very virulent in residual bile—*i.e.* bile retained in the gall-bladder by the presence of calculi preventing its escape. An infectious cholecystitis thus excited may cause an expulsion of calculi and so become the starting-point of hepatic colic and jaundice. This view would refer the origin of gall-stones to an *infective catarrh* of the bile ducts, dependent primarily upon a sluggish flow and *stagnation* of bile in those ducts.* This is practically the same view as that taken by Mayo Robson, who observes: "There is no doubt that catarrh of the mucous membrane of the bile passages increases the amount of cholesterin present, and that the longer the bile remains in the gall-bladder the more cholesterin it will contain. Anything, therefore, which causes stagnation of bile may dispose to gall-stones."* Some have suggested that an excess of cholesterin in the bile may be traced to nervous disturbances, especially those of an emotional nature, cholesterin being regarded as a product of nervous waste. This view was supported by the clinical observation that gall-stones are especially prone to appear in neurotic women: on the other hand, there is a large amount of evidence to show that the cholesterin is a natural product of the local catarrhal changes, and it has been shown experimentally that the introduction of cholesterin into the circulation does not increase the amount in the bile.

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* MM. Gilbert and Fournier (Paris) also assert that "ascending infection of the bile ducts takes place with extreme frequency under very various influences. Biliary stasis is its essential condition."

But although the subjects of gall-stone are often found amongst nervous women, they occur also with tolerable frequency in persons who have no neurotic tendencies whatever, and in such cases we must look for some other explanation. The amount of cholesterin in the bile being normal, it has been suggested that its precipitation may depend on some other chemical modification in the composition of the bile, such, for instance, as a diminution in the sodium salts; or acid fermentation of mucus diminishing the alkalinity of the bile. Again, Mayo Robson says: "It seems probable that free cholesterin in the bile passages is due, in many cases, to the deficiency of solvents of it in the bile; these solvents being the glycocholate and taurocholate of soda, which arise from the metabolism of *nitrogenous foods.* If the supply of nitrogen in the food be limited, the bile salts will be diminished, and cholesterin may be precipitated.

"It will thus be seen that in those who take an abundance of *albuminous* materials in their food, and where, therefore, the bile salts are in sufficient quantity, there is little tendency to the deposition of cholesterin; whereas when little albuminous food is taken, and the bile salts are presumably insufficient to hold the cholesterin in suspension, gall-stones form."*

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* Allbutt's "System of Medicine," vol. iv., p. 235.

The female sex predisposes to attacks of gall-stones, and statistics show that nearly four and a half times as many women as men suffer from this affection. This may be due, in part, to the more sedentary life women lead, or the constriction of the waist by tight-lacing, etc., may be a cause. The consumption of large quantities of fatty food has been, probably without sufficient grounds, held responsible for the production of gall-stones, for those races that live almost exclusively on fats have not been found to be specially subject to this malady.

Frerichs held that very long intervals between meals favoured the formation of biliary concretions. During digestion the bile flows freely into the small intestine, and the gall-bladder gets rid of a great portion of its contents; but if the meals are very far apart, there will be a tendency to stasis of bile in the gall-bladder, which would favour the deposition of cholesterin.

Sedentary habits and want of exercise, by diminishing the respiratory activity and the movements of the diaphragm and the abdominal viscera, must obviously tend also to promote stasis of bile in the gall-bladder, and, at the same time, by diminishing the combustion of fats, may lead to a modification in the biliary secretion favourable to deposition of cholesterin. Persons who inherit the gouty diathesis are considered specially prone to biliary as well as to renal calculi, and Beneke considered he had established a relationship between this affection and the occurrence of arterio-sclerosis. We have had occasion to notice that persons who perspire freely, and therefore lose much fluid from the cutaneous surface, and who drink but sparingly of water and other diluent fluids, are prone to become the subjects of calculous deposits, both biliary and urinary. We have also seen some remarkable instances of the influence of heredity in the causation of this disease.

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* *Op. cit.*, p. 256.

Dyspeptic states and habitual constipation, by producing an unhealthy condition of the alimentary canal, predispose to catarrh of the gall-bladder and bile ducts, and possibly also to stagnation of bile.

The common statement that the very corpulent are most prone to attacks of gall-stones is not consistent with our own experience, and in Beneke's extensive observations this coincidence was very rare. The majority of patients who have sought our own aid for this malady have been very spare subjects, and some of them have been accustomed to very active exercise.

Age has a determining influence, and post-mortem examinations have shown that while gall-stones are found in only 2.7 per cent of the bodies of those who die between fifteen and thirty, 5.9 per cent. are found in those between thirty and sixty, and 15·2 per cent. in those over sixty. Feebleness of circulation in the aged, by lessening the secretion from the bile ducts, favours stagnation and inspissation of bile.

A special association of gall-stones with mitral disease, especially mitral stenosis, is generally recognised, due no doubt to stagnation of bile, and in some cases to the presence of catarrh as well.

Pregnancy seems to favour the deposition of biliary concretions; possibly by interfering with the movements of the diaphragm, and compelling a sedentary life; or, as some have suggested, by compressing the excretory ducts, and so retarding the flow of bile. Naunyn has stated that 90 per cent. of women with gall-stones have borne children. Tight-lacing also interferes with the free flow of bile. It is probable that tight-lacing is of more consequence than pregnancy, as young women under thirty suffer from the disease four times more frequently than men of the same age.

The frequency with which gall-stones are found in connection with gastric and hepatic cancer may depend either on pressure, or on the co-existence of catarrh of the bile ducts ; but some physicians believe that gall-stones are not only the frequent precursor, but the actual cause, of malignant disease. There still, however, remains, as we have already said, much obscurity about the origin of gall-stones.

The **symptoms** of *gall-stones* are chiefly those attendant on the attacks of *biliary colic*, which arise during the passage of concretions of a certain size along the excreting ducts, or are determined by their impaction there. These attacks usually occur suddenly, probably at the moment when a concretion passes from the gall-bladder into the cystic duct and becomes arrested there. The pain is usually excessively severe, and, starting from the region of the gall-bladder, extends from the right hypochondrium over the whole abdomen, and may shoot through to the back and right shoulder. The abdominal muscles are contracted, and there is often great tenderness over the region of the liver, and this organ may be enlarged. The severe pain is usually attended with great distress and restlessness. The pulse is small, the face is pale and pinched, the skin cool, and drops of cold perspiration often stand out on the forehead. The pain is sometimes so severe and agonising as to cause the patient to faint, and it has been known to cause acute mania, and even to be fatal. Rigors are sometimes observed, with rise of temperature to 102° or 103° Fahr. Obstinate sympathetic vomiting often accompanies the attack. The intense pain is doubtless due to the slow and difficult progress of the stone along the cystic duct, or to the distension of the narrow duodenal orifice of the common duct. After a few hours, but sometimes much longer, the sufferings are usually moderated, and this remission probably corresponds with the passage of the calculus from the cystic duct into the common duct, as this is a somewhat wider canal, which becomes, however, narrower at its termination in the duodenum. When the concretion has escaped through the orifice of the common duct into the duodenum, the attack suddenly ceases. This sudden and complete relief of the pain and distress is very striking. In some instances the pain does not cease so suddenly, some irritation of the distended ducts still remaining.

Jaundice does not, of course, appear until the calculus has reached the common duct, and it is sometimes entirely absent; if the concretion is impacted in the common duct for a short period only, the jaundice will be slight, but if it should remain long impacted at the orifice of the common duct, the jaundice becomes intense; the gall-bladder becomes distended, the liver enlarged, and sooner or later symptoms of toxæmia appear. The calculus (sometimes there are several), having passed into the duodenum, can usually be found in the fæces by careful examination.* If no calculus is found after the cessation of an attack of biliary colic, it is always possible that the stone may have slipped back into the gall-bladder. Impaction of a gall-stone in the cystic duct, although unattended with jaundice, may give rise to tumour of the gall-bladder from accumulation of secretion in it.

What leads to the passage of the stones out of the gall-bladder into the cystic duct we do not certainly know, nor why in some persons these concretions should remain all through life in the gall-bladder, giving rise to no symptoms. We have already referred to Naunyn's suggestion that in some instances the expulsion of calculi from the gall-bladder is due to the setting up of an infective cholecystitis.

Vomiting is a common symptom during attacks of biliary colic, and may occasionally lead to relaxation of the duct, and if the concretion be small it may pass on and so terminate the attack.

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* The motions should be passed into a solution of carbolic acid, then well stirred, and passed through a fine sieve with about $\frac{1}{16}$-inch mesh.

In cases attended with jaundice, after the attack of colic has passed off there often remain, not only great lassitude, but entire loss of appetite, nausea, with tendency to vomiting, emaciation, and dark, bile-stained urine.

Some authors describe attacks of a slighter kind, which they believe to be dependent on the passage of biliary "grit" or "sand" (*gravelle hépatique*) along the bile-ducts, setting up a certain amount of irritation of the mucous lining of the ducts, not, however, reaching the intensity of an attack of biliary colic. Such patients complain of epigastric pain and discomfort, with disturbed digestion, often with slight feverish attacks, coming on in the afternoon, a sub-icteric tint of skin, and tenderness on pressure over the region of the gall-bladder.

The **indications for treatment** may be considered under two headings: 1, During the crisis. 2, During the intervals.

1. The indications for treatment *during the paroxysms* are:—

(*a*) To relieve or calm the distressing symptoms; and

(*b*) To promote the expulsion of the calculus or calculi in the ducts, especially when the attacks are prolonged.

2. *During the intervals*, the indications for treatment are—

(*a*) To prevent the formation of concretions by increasing as much as possible the amount and fluidity of bile secreted and promoting the activity of its flow.

(*b*) To promote the discharge of concretions remaining in the gall-bladder; or,

(*c*) If possible, to further their solution.

It is extremely doubtful if any medicines taken into the stomach can possibly lead to the solution of the larger concretions already formed in the gall-bladder. But it seems quite possible that by modifying, to a certain extent, the physical and chemical properties of the bile, and by promoting the activity of its flow, which we may be able to do, we may prevent the further deposition of cholesterin, and also hinder the increase in size of the calculi already in the gall-bladder, or even promote the solution and softening or disintegration of the smaller forms of hepatic "gravel"; and, when the bile ducts have been dilated by the passage of large calculi, as proved by their recovery from the fæces, we may hope to promote the almost painless discharge of such smaller ones as still remain in the gall-bladder.

After we have considered how these indications may best be fulfilled by medical treatment we shall briefly discuss the circumstances that may render it necessary to have recourse to surgical interference.

First, with regard to the **treatment during the paroxysm.** We must remember that the walls of the excretory bile ducts are furnished with involuntary muscular fibre, and therefore they can be excited to spasmodic contraction; that these ducts are lined with an exquisitely sensitive mucous membrane, and the contact and pressure of a foreign body, such as a gall-stone, while it excites, as we know, great pain, no doubt provokes also reflex spasmodic contractions of these involuntary muscular fibres, so that there is as it were an active as well as a passive resistance to the transit of the gall-stone along the gall-ducts. To remedy these conditions we require the aid of medicinal agents which shall produce an anæsthesia of the sensitive and excited mucous membrane, and a relaxation or paralysis of the reflexly excited muscular fibres. Clearly this is the first and most direct indication; we may, at the same time, or subsequently, attempt to increase the flow of bile so as mechanically to dilate the gall-ducts and facilitate the passage of the calculus by a sort of *vis a tergo.*

The most rapid method of relieving the pain and the sensitiveness and spasm of the bile ducts is by the hypodermic injection of morphine, and it acts best, we consider, when combined with atropine; a $\frac{1}{4}$ or $\frac{1}{3}$rd grain of sulphate or acetate of morphine, with $\frac{1}{120}$th grain of sulphate of atropine, may be administered at once, and repeated after an hour or two if needful. We must be alive to the fact that there are individual peculiarities with regard to the toleration of morphine, and it is therefore well to begin with small doses. Some tolerate it well and require larger ones. If there is not very constant vomiting, opium or morphine may be given, in combination with some gastric sedative, by the stomach, and it often acts extremely well so administered, calming the reflex gastric irritability as well as relieving the local pain. We may give morphinæ hydrochlor. $\frac{1}{6}$ to $\frac{1}{4}$ grain, succi belladonnæ 20 minims, acid hydrocyanici dil. 5 minims, in aquæ chloroformi 1 oz. This draught may be repeated, if necessary, after two or three hours. To persons who bear morphine badly this is a far safer mode of giving it than by hypodermic injection, owing to the very rapid absorption of the drug in the latter case.

If the pain is excessively severe, it may be desirable to administer a little chloroform by inhalation, until the morphine has time to act; or if the morphine fails to relieve, we may have recourse to chloroform or ether inhalations.

It has been objected to the use of morphine and opium that they diminish the flow of bile, and so favour impaction, and that, therefore, in these cases chloroform inhalation is better, or hydrate of chloral given *per rectum*. But although morphine does no doubt diminish the secretion of bile, it seems to do so less when combined with atropine, and we have no agent at all equal to it for the sustained relief of pain and removal of spasm. The first step in the treatment of biliary colic should, then, we consider, be the administration of morphine or opium. Warm baths and warm fomentations, and mustard poultices applied to the right hypochondrium and to the epigastrium have been recommended, and are doubtless useful aids in relaxing spasm and relieving pain, but they are of very little use alone, and when combined with sedatives it is difficult to say what is their precise share in producing the relief afforded. A measure which we never fail to apply, and which has been warmly commended by some of the most experienced physicians, is to cause the patient to drink large draughts of hot water in which some sodium bicarbonate has been dissolved, and we now add some sodium salicylate; 60 grains of sodium bicarbonate and 20 grains of sodium salicylate should be dissolved in a pint of hot water, and the patient should be made to drink this in mouthfuls. If it is vomited at first, it should be persevered with until it is retained, and it should be frequently repeated until the attack has passed away. This drink not only serves the purpose of diluting and promoting the flow of bile, but it acts as an internal warm fomentation (and it should be drunk as hot as possible) which probably reaches the duodenum. It is especially valuable as a corrective to the morphine, for it promotes the flow of bile by increasing its fluidity, and so favours the mechanical urging forward of the calculus through the bile-ducts after the spasm has been allayed by morphine.

Expedients suggested by Mayo Robson for relief of the pain are 30 drops of spiritus ætheris in two teaspoonfuls of chloroform water every quarter of an hour, and exalgine in 1-grain doses dissolved in a teaspoonful of hot brandy and water, and repeated every half hour for three or four times.

A combination of extract of belladonna and podophyllin, $\frac{1}{4}$ grain of each, in a pill has been highly lauded as a remedy for gall-stones, but we do not consider it merits the praise it has received. It is, however, advantageous, from the special action of belladonna on involuntary muscular fibre, to combine it (or atropine) with morphine in the manner we have already described.

We prefer hot drinks and hot applications to iced drinks and the local application of ice, which have been suggested.

In cases of *protracted* pain with tenderness and enlargement of the liver, the free application of hot poultices or of leeches over the right hypochondrium has been found to give relief. If the patient should become collapsed from the exhausting effect of the severe pain, ether, ammonia, and brandy must be given to revive him. Persistent vomiting may be best controlled by swallowing small fragments of ice. Purgatives should not be given during the paroxysms, but an enema of warm soap and water with a little turpentine is useful if there is tympanites; nor do we favour the use of emetics, from which, however, some practitioners have obtained advantage.

Olive oil in large doses has been stated by many authorities to be of great efficacy in relieving the paroxysms of biliary colic; but though there may be room for difference of opinion as to its power of preventing recurrence, it is inconceivable that it can have any influence in an acute paroxysm, unless it be by promoting vomiting.

Ralfe recommended 5-minim doses of spirit of turpentine during the paroxysm; he considered turpentine to act as a direct expulsive agent, by increasing the flow of bile, and by stimulating the muscular fibres of the gall-bladder and biliary ducts.

We come, *secondly*, to the consideration of the **treatment** of cases of gall stones **in the intervals** between the attacks of biliary colic.

The first question which now arises is this: when, after an attack of biliary colic, and the passage of one or more angular and facetted calculi by the bowel, we are convinced there remain other concretions in the gall-bladder, is it desirable to endeavour to promote their expulsion and discharge; or, when we reflect that biliary concretions in large numbers may and do exist in the gall-bladder without giving rise to any symptoms, may it not be wiser to allow them to remain there and not make any active attempt to disturb them? The answer must, we think, depend upon the course and character of each individual case. Manipulation or "massage" of the gall-bladder with the object of expelling concretions lodged therein is of very doubtful expediency. Osler speaks strongly on this point. He says: "Expulsion of gall-stones from the bladder by digital manipulation, as recommended by George Harley, is a highly irrational procedure, not to be followed. So long as gall-stones remain in the bladder they do little or no harm in a great majority of cases. To force them on into the duct is to render the patient liable to severe colic or to the still more serious danger of permanent obstruction." And Mayo Robson says: "Were we the subjects of cholelithiasis we would not submit to massage, nor could we conscientiously recommend it to others."*

If, however, by augmenting the amount and increasing the rapidity of the flow, and diluting and diminishing the viscidity of the bile, or by altering its chemical characters, as by increasing its alkalinity, we can prevent the further deposition and formation of concretions, or promote the rapid discharge of numbers of small ones already accumulated in the gall-bladder, which periodically expose the patient to great suffering or to continued loss of health, it is certainly right and necessary to do so.

After the cessation of a paroxysm of biliary colic it is advisable to give some mild but efficient aperient, and to continue to administer freely warm alkaline drinks; we shall thus promote the free secretion and outflow of watery bile, and minister to the discharge of such small or moderate-sized concretions as can pass easily through the excretory ducts. At the same time we shall be doing much to remove the infective catarrh that plays so important a *rôle* in their formation. Numbers of calculi may often by such means be discharged and collected from the alvine evacuations.

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* "Diseases of the Gall-Bladder and Bile Ducts" (2nd edition), p. 170.

The idea of giving medicines to dissolve the concretions in the gall-bladder—as, for instance, Durande's mixture of ether and turpentine—is not tenable; and if the use of this mixture has been attended by any good result, it would probably be on account of its antispasmodic and stimulating properties, or it is possible it may be of use as an antibacillary agent. Ralfe was an advocate of its use. He *thought* it exerted an antiseptic action on, and arrested decomposition of, bile; and that it prevented the formation of "recurrent" gall-stones, "either by expelling precipitated cholesterin, mucus, and pigment before they have time to form in concretion; or else by preventing precipitation by its action on the bile and biliary passages." It is needless to say that it is useless to give drugs with the idea that they can exercise any direct solvent influence on the concretions in the gall-bladder. They can only act on the contents of the gall-bladder by causing modification of the biliary secretion.

Olive oil in large doses has been given with a view to preventing recurrence of colic, by solution of the offending gall-stones. Some have given as much as 6 to 12 ounces at a dose. Others have given small doses, ½ an ounce to 1 ounce, three or four times a day. An immediate expulsion of calculi has been said to follow such treatment. This has, however, been denied, and it has been asserted that no true gall-stones have ever been found in the motions as a result of the administration of olive oil, but that the supposed calculi consist of oleic, palmitic, and margaric acids combined with lime, and that such concretions may be produced at any time by giving olive oil to persons suffering from defective secretion of bile.

Mayo Robson says: "We have tried olive oil in large doses in many cases, and cannot say that we have seen much good result from its employment, unless, perhaps, in one case of impacted calculi in the common duct, where an operation was performed after the olive oil treatment had been tried for some weeks. The gall-stones were then found to yield more readily than usual to the pressure of the finger and thumb, as if the treatment had lessened their consistency." He quotes Dr. Brockbank's suggested explanation of the mode of action of olive oil. "A digested fat passes into the circulation from the alimentary canal in three forms: as unchanged fat, as the corresponding fatty acid, and as soap. All occur normally in the bile, and the amount present in the bile increases with the amount of fat taken in the diet. Oil, fatty acids, and soap all dissolve cholesterin readily and break up a gall-stone. If, then, the oil, fatty acid, and soap appear in the bile in increased amount after large doses of oil, it is very probable that the gall-stone is attacked by them, especially by the soap, and in time is dissolved or so reduced in bulk as to be enabled to pass out into the duodenum."

Two to 10 ounces of the oil may be given daily, either by the mouth or by the rectum. It is borne better *after* food.

Osler states that olive oil has proved useless in his hands.

Calomel, castor oil, podophyllin, euonymin, iridin, all have been advocated as cholagogues to be given to favour the removal of concretions from the gall-bladder. It is certain, however, that the cholagogue action of these drugs is apparent, not real, and due to the expulsion of bile from the bowel before it has time to be reabsorbed. Still there is good reason to believe that aperients cause some contraction of the muscle of the bile-ducts and gall-bladder, and so may assist outflow. Perhaps as useful a means as any consists in giving ½ grain of calomel with 4 grains of compound rhubarb pill every night at bed-time, and 2 drams of Carlsbad salts in a tumblerful of hot water early the next morning, and this latter dose may be repeated after an hour or two if free evacuation has not been produced; or we may give 2 grains of euonymin or $\frac{1}{4}$ of a grain of resin of podophyllin, or, better still, 4 grains of iridin in place of the calomel. If we adopt the plan of giving an ounce and a half of olive oil every night, the addition to it of a dram of castor oil will greatly increase its activity. Strong purgatives should be avoided, as they are apt to excite intestinal catarrh. The long-continued use of sodium salicylate has been advised, as a true active cholagogue rendering the bile more abundant and more fluid, and also acting as an antiseptic. It may be given in doses of 15 grains three times a day with 10 grains of sodium bicarbonate dissolved in 4 ounces of warm water.

While we are giving these cholagogue aperients, and so possibly causing a considerable loss of watery fluid by the bowels, we should, at the same time, insist on the consumption of considerable quantities of warm alkaline fluid by the mouth, so as to make the bile thinner and hasten its movements through the ducts. A tumblerful of Vichy or Vals water, warmed, or, what answers pretty nearly the same purpose, a tumblerful of hot water, with 20 grains of sodium bicarbonate dissolved in it, should be drunk slowly three times a day—half an hour before lunch and dinner and at bed-time. Courses of mineral waters, such as Carlsbad, Marienbad, Vichy, Kissingen, Brides, and others, have justly acquired a great reputation in the treatment of gall-stones. They act as cholagogues, as purgatives, and as diluent alkaline fluids, and as such tend to keep the intestine and gall-bladder in a healthy state. In resorts such as Carlsbad, where strict dietetic measures are also enforced, a very beneficial influence no doubt may be produced on the constitutional vice upon which their formation depends.

But it is by no means always essential that patients should be at the trouble and expense of travelling to these resorts, if they will be content to submit to the same orderly and strictly regulated life, and drink the imported waters, raised to a proper temperature, at home. We have obtained excellent results from the application of courses of Carlsbad waters in cases of gall-stones, at home, when the patients have been willing to consent to adopt the strict regimen we have prescribed.

That the Carlsbad waters act in the manner we have suggested is admitted by those who have had the largest possible opportunities of watching their action. "The disappearance of stones," says Kraus, "is not due to their being dissolved . . their elimination is caused by the mechanical action of the waters . . by the thinner and normal condition of the bile during their use, by which the formation of fresh concretions is evidently prevented."* When, as often happens at Carlsbad, calculi of large size are eliminated, severe attacks of colic frequently occur, followed often by jaundice. This is one reason why it would be better for many patients, if they would submit to the regimen necessary, that they should take a course of Carlsbad at home. Naunyn has expressed a belief that hot Carlsbad water acts rather by stimulating the muscular coat of the gall-bladder than by its chemical action on the bile, and he states that he has found the injection of large quantities of warm water into the rectum act similarly.

The Vichy course is also of great value in the treatment of gall-stones, and leads to their elimination, often with attacks of biliary colic, as at Carlsbad. But the Vichy water, being in the main simply a solution of sodium bicarbonate, has little or no effect over the constipation from which such patients constantly suffer, and it is usual there to prescribe the occasional additional use of an aperient water, such as Apenta.

The diet and mode of life of a patient who is the subject of gall-stones should be carefully regulated.

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* "Carlsbad, its Thermal Springs and Baths." London, Trübner.

If his or her mode of life is sedentary it should be altered, and a certain amount of active physical exercise insisted upon. When there is any difficulty about open-air exercise, systematic respiratory exercises may be carried out at home. Too many hours passed consecutively in the recumbent position should also be prevented, and six or seven hours only in bed might be supplemented by an hour or two of repose in the afternoon. If the patient, on the contrary, is of active habits, but accustomed to perspire very freely on exertion, we should insist on the excessive loss of water by the skin being more than compensated for by the free use of dilute alkaline drinks, such as Apollinaris, soda, or seltzer waters, or simple pure soft or distilled water (not water rich in lime salts). It is best that these be drunk warm, slowly, and when the stomach is empty, as at bed-time, or an hour or half an hour before meals. Digestive disturbance of any kind must be corrected. Constipation should be guarded against. When the action of the skin is defective this should be stimulated by hot baths daily, or on alternate days, followed by cold sprinkling and friction with a rough towel, or by gentle massage, and warm clothing should be worn.

Females should be cautioned against the dangers of tight-lacing, or of wearing tight bands round the waist.

The **diet** should be strictly moderate, and excess of food of any kind must be avoided. It has been assumed rather than demonstrated that an excessive consumption of fat favours the production of an excess of cholesterin, and so promotes the formation of biliary concretions, and an avoidance of animal fats is usually urged in these cases. This may be true of animal fats, but it certainly does not appear to be so with regard to vegetable fats, such as olive oil, as attacks of gall-stone are said to be rare amongst Italians, who consume olive oil freely.

Sugar and farinaceous foods should be taken only in very small quantities; bread should be eaten sparingly, and best in the form of dry toast. We have already quoted Mayo Robson's reasons for considering that a diet composed largely of albuminous materials is better for such patients than carbo-hydrates, which should be taken in great moderation. Animal food should form the basis of the diet, or such vegetable foods as are rich in nitrogen. Free use may be made of fresh green vegetables, salads, and ripe fruits; the coarse, hard, indigestible kinds, of course, must be avoided.

For a beverage, a little sound hock, still Moselle, or Bordeaux wine, mixed with some alkaline table water, may be permitted.

Finally, it remains to be considered when **surgical interference** may be necessary in the treatment of gall-stones.

1st. A stone impacted in the cystic duct, although unattended by jaundice, may give rise to so much suffering, and may lead also to such great dropsical distension of the gall-bladder as to call for surgical operation; and the same will sometimes be the case with large calculi in the gall-bladder, as they not unfrequently give rise to severe attacks of pain, possibly owing to fruitless attempts to pass out of it.

2nd. When the attacks of biliary colic are so frequent as to make life intolerable, and to preclude the use of morphine, surgical intervention is indicated.

3rd. When gall-stones are impacted in the common duct, and give rise to intense and permanent jaundice, and all medical treatment fails to give relief, our only resource is surgical operation; the difficulty here, however, is one of diagnosis, for very similar symptoms may be caused by obstruction of the common duct from malignant disease, and such cases are very unsuitable for operation. Osler states that the existence of the following combination of symptoms is characteristic of obstruction of the common duct by gall-stones: (1) Jaundice of varying intensity, deepening after each attack of colic, and persisting for months, or even years; (2) ague-like paroxysms, consisting of chill, fever, and sweating, followed usually by intensification of the jaundice; (3) at the time of the paroxysm pains in the region of the liver, with epigastric disturbances.

4th. Empyema of the gall-bladder, or evidence of suppuration in its neighbourhood, would call for operation.

5th. Operation may be indicated when acute peritonitis, local or general, arises as a complication in a case which has been previously recognised as one of gall-stone.

6th. When adhesions about the bladder lead to persistent pain and gastric disturbance.

7th. When the escape of a large stone into the intestine has led to intestinal obstruction.

8th. For the remedy of certain conditions of biliary fistula.

The following are the various operations which have been performed in connection with such cases:—

(1) *Sounding*, *i.e.* introducing a long fine needle, or a fine probe, through a cannula, to sound for stones in the gall-bladder. This operation has proved fatal, and is generally rejected by surgeons, who prefer, if exploration is necessary, to make a small incision over the gall-bladder, so as to introduce the finger.

(2) *Aspiration*, by means of a fine perforated needle, in cases of distended gall-bladder. This operation, however, is subject to grave risk, and can rarely give more than temporary relief. Great care must be taken, by cleansing the surface to be punctured as well as the needle to be used, that asepsis is secured, and the gall-bladder should be completely emptied, and all tension removed.

(3) *Choledochotomy*, incision of the ducts, especially the common duct, for removal of stones: this has now quite replaced cholelithotrity.

(4) *Cholelithotrity* aimed at crushing the stone in situ, without incision of the duct, and allowing the fragments to pass away by the natural channels.

The operation besides being uncertain in its results involved the danger of serious injury to the ducts.

(5) *Cholecystostomy.* This consists in opening the gall-bladder, examining the ducts and removing stones, and draining the gall-bladder, so as to get rid of the infective catarrh that is always present. It is the operation performed nowadays in the large majority of cases, and gives excellent results.

(6) *Cholecystotomy* has quite given place to cholecystostomy. The essential difference was, that the gall-bladder was closed at the time of operation. There is the great objection that nothing is done to relieve the infective catarrh, and there is at the same time danger of leakage of the gall-bladder.

(7) *Cholecystectomy*, or removal of the gall-bladder. This operation should be done when the gall-bladder is shrivelled and empty, so that it cannot conveniently be stitched to the abdominal wall : if a stone is impacted in the cystic duct, which cannot be easily dealt with otherwise : in the presence of suppuration : and if there is any suspicion of malignant disease.

(8) *Cholecystenterostomy* is an operation which has for its object the establishment of a fistula between the gall-bladder and the intestine, in cases of incurable biliary fistula, due to insuperable occlusion of the common bile duct and obstructive jaundice, from the same cause. This operation is rarely performed nowadays.

ADDITIONAL FORMULÆ

Durand's solvent for gall-stones

℞ Olei terebinthinæ, ʒiij.
Ætheris sulphurici, ʒij.

M. Half a teaspoonful night and morning (in some vehicle).

Powder for gall-stones

℞ Sodii benzoatis }
Sodii salicylatis } āā gr. lxxv.
Pulveris nucis vomicæ, gr. vij.

M. et divide in pulv. xx. One three times a day for two months.

Or

℞ Sodii benzoatis
Sodii salicylatis } āā ʒj.
Pulveris rhei
Pulveris nucis vomicæ, gr. v.

M. et divide in pulv. xx. One at each meal. (*Huchard.*)

Turpentine emulsion for gall-stones

℞ Olei terebinthinæ, ♏v.
Misturæ acaciæ, ℥ss.
Sodii sulpho-carbolatis, gr. xx.
Spiritus chloroformi, ♏xv.
Aquæ menthæ piperitæ ad ℥j.

M. f. haust. To be taken three times a day. (*Ralfe.*)

Glycerine in biliary colic

Four to six drams to be taken during the attack.

One to three drams in alkaline water, daily, to prevent attacks. (*Ferraud.*)

Chloroform mixture for biliary colic

℞ Chloroformi, ♏xv.
Tincturæ myrrhæ, ♏xv.
Mucilaginis, ʒij.
Syrupi ad ℥iv.

M. f. mist. A tablespoonful every fifteen minutes. (*Lemoine.*)

Another

℞ Chloroformi, ʒss.
Olei amygdalæ dulcis, ʒj.
Syrupi aurantii, ℥jss.

M. f. mist. A tablespoonful every quarter or half hour. (*Tourasse.*)

Another

℞ Chloroformi, ʒijss.
Alcoholis diluti, ℥ijss.
Syrupi aurantii, ℥viij.

M. f. mist. A small wineglassful twice a day. (*Bouchut.*)

Suppositories for biliary colic

℞ Extracti belladonnæ } āā
Extracti opii } gr. ss.
Olei theobromæ, ʒjss.

M. f. suppos. (*Dujardin-Beaumetz.*)

Rosenberg's olive oil mixture

Olive oil, 5 to 7 oz.
Brandy, ½ oz.
Menthol, ½ dram.
Yolks of 2 eggs.

Mix. To be taken in three or four hours, two tablespoonfuls at a time.

Solvent for gall-stones

℞ Chloroformi
Ætheris sulphurici } āā ℥ss.
Olei terebinthinæ, ℥j.
Sacchari albi, ʒij.
Mucilaginis acaciæ, ℥ij.

M. A teaspoonful three times a day. (*Jackson.*)

CHAPTER II

TREATMENT OF JAUNDICE

Obstructive Jaundice—Etiology. Gall-stones—Catarrhal causes—Stricture of Duct—Compression from Malignant and other Growths or Tumours—Mental Depression—Symptoms of Obstructive Jaundice—Discoloration of Skin and Urine—Itching of Skin—Loss of Appetite—Constipation—Pale Stools—Slow Pulse—Depression of Spirits, etc.—*Indications for Treatment in Catarrhal Cases*—Local Applications—Diet—Warm Alkaline Drinks—Aperients—Enemata of Cold Water, etc.—Emetics—Ipecacuanha—Nitrate of Silver—Quinine and Arsenic in Malarial Cases—Colchicum—External Treatment—Courses of Mineral Waters in Chronic Cases—Carlsbad, Vichy, etc.—Nitro-hydrochloric Acid—Diet in Chronic Cases—Intestinal Catarrh and Antiseptics—Treatment of the Cutaneous Irritation—Baths—Warm Drinks—Pilocarpine—Warm Clothing—Treatment of Cholæmia—Gymnastic Exercises—Diuretics—Tonics—Change. *Jaundice of New-born Children.* Additional Formulæ.

When, from any cause, the colouring matter of the bile fails to be normally eliminated and mixes with the general circulation, so that the patient's skin and conjunctivæ become stained *yellow* with bile pigment (*bilirubin*), he is said to have **jaundice.**

Jaundice, therefore, is but a *symptom* which may be dependent upon a variety of morbid states, as we shall see; it has, however, been aptly said that "jaundice is a symptom with symptoms."

As a symptom jaundice also arises in the course of diseases which are wholly incurable and unamenable to any kind of remedial treatment.

Jaundice was formerly described as of two kinds; that is to say, as arising in two different ways. *First*, jaundice from *obstruction* to the outflow of bile along the biliary ducts, so that the bile is re-absorbed into the blood; and *secondly*, jaundice arising *without obstruction* and re-absorption, and supposed to be dependent on certain blood changes. These two forms were spoken of as *hepatogenous* and *hæmatogenous* jaundice.

Now, however, it is generally recognised that all jaundice is obstructive, and that whereas in the so-called "hepatogenous" form the obstruction is in the large extrahepatic ducts, in the "hæmatogenous" it is in the minute intrahepatic channels, and is always of toxic origin. Thus we meet it in septicæmia, acute yellow atrophy, typhoid, pernicious anæmia and other infective processes: in poisoning by phosphorus, chloral, snake-bite, and toluylendiamine. Such jaundice often occurs along with excessive hæmolysis, and the two are not related as cause and effect, but as common results of a general toxæmia. The jaundice is, as a rule, an insignificant symptom, that calls for no treatment as such, occurring in the course of a more or less profound constitutional disorder.

A common cause of ordinary jaundice is the presence of biliary concretions in the bile-ducts. The presence of gall-stones in the ducts, however, is not always, or necessarily, attended with jaundice. A concretion in the cystic duct, although it may lead to retention of mucus secreted by the gall bladder, and so cause distension of this organ and all the symptoms of gall-stone colic, does not cause jaundice, as it leaves the common duct free for the flow of bile into the intestine. So also an angular stone of comparatively small size, although it might be in the common duct and give rise to considerable suffering during its passage through it, yet might leave room for the bile to flow on into the intestine, and there would be no jaundice. The treatment of this form of obstruction has already been fully considered in the preceding chapter on the treatment of gall-stones.

It is clear that jaundice may occur either from an obstacle within the ducts blocking the bile channel, or from disease of their walls attended with tumefaction or constriction, or from pressure from without compressing and obliterating the channel.

An obstacle within the duct is most likely to be a gall-stone, although merely inspissated bile and hepatic sand or gravel, or a plug of mucus may temporarily obstruct the duct and cause jaundice. The common duct has also been found obstructed by an intestinal worm.

It is generally believed that one of the most common causes of jaundice, especially of the milder forms of short duration, is an inflammatory **catarrhal** condition of the common duct, or perhaps more frequently a catarrhal swelling and obstruction of the duodenal opening of the common duct, arising in connection with an attack of catarrhal gastro-duodenitis. We speak of such attacks as attacks of catarrhal jaundice, and they may doubtless arise in connection with chill or with dyspeptic attacks from offending ingesta. Some physicians appear to think that we assume too much in referring most of these mild and brief forms of jaundice to catarrhal causes, and argue that this view is not supported by the occurrence of analogous catarrhal attacks in other strictly limited portions of mucous membrane. But we may point out, in the first place, that the duodenum must, from its position, bear the brunt, as it were, of much of the irritation that arises from faulty gastric digestion or from the introduction of indigestible substances into the alimentary canal; the passage into the duodenum of excessively acid chyme may often provoke a temporary catarrh of that organ, and the reason temporary jaundice does not occur more frequently from this cause is no doubt to be found in the circumstance that the catarrh does not generally extend to the common duct or involve its orifice, at any rate to a degree sufficient to present an insurmountable obstacle to the flow of bile through it.

And in the second place we certainly *are* familiar with the circumstance that there is great individual peculiarity as to the sensitiveness of particular limited portions of mucous membrane to catarrhal changes, from *chill* or other irritants. In some the nasal mucous membrane, in others the laryngeal, in others the pharyngeal, in others the bronchial, although in actual continuity, will sometimes become catarrhal alone without any involvement of the others.

So also some persons after exposure to chill will at once show signs of a slight vesical catarrh, others of intestinal catarrh, and so on; so that there is abundant analogical support in favour of the view that these attacks of jaundice are catarrhal.

The common duct may also become obliterated by *stricture*, caused by the cicatrisation of an ulcer produced by the irritation of a gall-stone, or, in very rare instances, a polypus or other growth may arise within the duct and obstruct it; these and sundry other obstructive conditions can, it is clear, be only relieved by such surgical interferences as we have referred to in the last chapter.

There is also little to be done by way of medical treatment for those cases of jaundice that occur from compression of the bile-ducts by malignant or other growths arising in their neighbourhood. Enlarged glands, tubercular or cancerous, in the fissure of the liver, or malignant or other growths connected with that organ, or with the pancreas, stomach, omentum, etc., or aneurysms of adjacent vessels, or fæcal accumulations in the colon, or a pregnant uterus may cause jaundice by pressure upon the excretory ducts. Many of these conditions are not amenable to medical treatment, and an accurate and certain diagnosis, without operative exploration, is often quite impossible.

Enlargement of the head of the pancreas, either from malignant disease or chronic inflammation, may lead to jaundice. In the latter case remarkable recovery occasionally results from drainage of the gall-bladder, possibly by relieving an infective catarrh.

A peculiar class of cases are those due to *mental shock* or depressing emotions: they lose, perhaps, part of their mystery if we consider the profound influence of emotion on gastric and intestinal functions.

The jaundice that sometimes occurs, in greater or less degree, in association with active and passive hyperæmia of the liver, and in cirrhosis, needs no special consideration apart from these diseases.

It will be evident, then, that apart from those cases already dealt with in considering the treatment of gall-stones, it is chiefly catarrhal cases that can effectively be relieved by medical treatment.

The **symptoms** observed in jaundice are the following: 1. The most striking symptom, and the one from which the disease is named, is the *yellow discoloration* of the skin, which may vary from a pale yellow tint to an olive green, or even greenish black, according to the completeness or duration of the obstruction. It is in cases of permanent obstruction that these darker tints are encountered. 2. Distressing *itching* of the skin is a very common symptom in chronic cases; other forms of cutaneous irritation also often appear—lichen, urticaria, etc. 3. Some of the secretions, and especially the urine and the sweat, are coloured with bile pigment. This change is sometimes manifest in the urine before the skin is affected. 4. There is often nausea, entire loss of appetite, and consequent emaciation. 5. The motions lose their natural dark colour and become pale drab or clay-coloured, and they are often very fœtid, owing to the absence of bile from the intestinal canal. Usually there is constipation, and at other times, from the irritation of intestinal decomposition, there may be diarrhœa with flatulence. 6. Great slowing of the pulse has often been noted in jaundice (to 50, 30, or even 20 in the minute). 7. A proneness to hæmorrhage and to ecchymoses is a well-known feature in jaundice, especially in the severe forms. 8. Languor, sleepiness, melancholy, and great depression of spirits are notably present in these cases. Other features of *cholæmia* or bile intoxication, which may appear in aggravated and protracted cases, are convulsions, delirium, and even sudden and fatal coma.

The existence of greater or less enlargement of the liver may often be made out in these cases.

Simple catarrhal cases are usually characterised by the absence of severe local pain and the somewhat rapid development of jaundice while in a condition of fairly sound health, and commonly after exposure to chill, or an attack of dyspepsia.

The **indications for treatment** in catarrhal jaundice are: 1st, to allay the catarrhal inflammation and swelling, and so remove the obstruction of the duct. 2nd, to further the removal of the obstacle by, if possible, promoting the flow of bile; and 3rd, to combat the symptoms due to the presence of bile in the blood and its absence from the intestine.

The first indication is best carried out by the local application of hot poultices of linseed meal and mustard; these are especially useful when there is some enlargement of the liver, with tenderness or uneasiness in the epigastric or right hypochondriac region. At the same time there should be a strict limitation of the diet to the simplest and plainest forms of food, and even these should be taken in small quantity. It should be remembered that the stomach and the duodenum are assumed to be in an inflamed and catarrhal condition, and that functional rest is of all measures the best for the removal of this state. The food then should, for a time, consist, if practicable, exclusively of warm milk and water, or, better still, of warm milk with an equal quantity of Vichy or Apollinaris water, or, what does equally well, of warm milk and water with 10 grains of sodium bicarbonate to each breakfastcupful. These warm dilute alkaline drinks, which may be given almost *ad libitum*, are soothing to the irritated mucous membrane of the stomach and duodenum; they remove acidity, and they favour the secretion of thin and highly-fluid bile, while they also tend to dissolve any stringy or inspissated mucus they may come in contact with. If the patient will not be content with so rigorously abstemious a regimen, we may allow, in addition, some thin peptonised cocoa and milk, or peptonised gruel, made with finely-ground oatmeal, or some thin arrowroot, or we may permit, occasionally, a little consommé thickened with sago or tapioca. At the same time the patient should drink freely of warm Vichy, Vals, or Apollinaris water, or a weak, warm solution of sodium bicarbonate. The bowels should be kept freely relieved, and any tendency to engorgement of the portal vessels removed by mild unirritating aperients, which will also favour the mechanical displacement of any plug of mucus which may possibly be obstructing the duodenal orifice of the bile duct. At the commencement of the treatment a small dose of calomel, $\frac{1}{2}$ a grain or a grain, with 2 grains of extract of henbane at bed-time, followed the next morning by one or two teaspoonfuls of Carlsbad salts in a tumblerful of hot water, is perhaps as good an aperient as can be given. Afterwards, 2 grains of euonymin or 4 grains of iridin may take the place of the calomel, but the Carlsbad salts should be continued until the jaundice shows signs of abating, or until the obstruction has been removed, as would be evidenced by the reappearance of bile in the motions. It is needful to watch for any change in the appearance of the stools, as from these we derive the first intimation of the yielding of the obstruction. Simple catarrhal jaundice seldom lasts more than six weeks, often much less. We do not approve of the use of *strong* "cholagogue" purgatives: so far as we know, they do not cause any actual increase in the amount of bile secreted by the liver; and if, perhaps, they do excite some contraction of the muscle of the bile-ducts and gall-bladder, they are only too likely to increase the existing catarrh.

Nausea and vomiting may require treatment with small frequent doses of bismuth, along with diluted hydrocyanic acid or glycerine of carbolic acid.

The injection of cold water (temperature 60° F., gradually raised to 72°) into the rectum slowly by means of an irrigator, from 40 to 50 ounces at a time, according to the tolerance of the patient, and retained as long as possible and often repeated, has been advocated by Krull (and lauded by Dujardin-Beaumetz) as a cure for catarrhal jaundice; we are, however, more in accord with Osler, who says: "This practice has been followed in my wards for several years, but I cannot speak warmly of the results." But if it should be found difficult to overcome the tendency to constipation by such aperient measures as we have indicated, we would give twice daily large enemata of warm water containing sodium sulphate and carbonate, $\frac{1}{2}$ ounce of the former and 1 dram of the latter to each pint. These should be given in the knee-elbow position or with the buttocks raised on a hard cushion, and retained for ten or fifteen minutes, or even longer. Some physicians recommend an emetic to be given at the onset of catarrhal jaundice—20 grains of powdered ipecacuanha in half a pint of hot water every half hour until vomiting is produced; by this means, they believe, sufficient pressure on the bile passages may be produced to dislodge a plug of mucus or other obstacle in the biliary canal.

In place of warm solutions of sodium bicarbonate, which, as we have said, we think the best remedy, others use sodium phosphate, benzoate, or salicylate, or ammonium chloride. Any of these may be employed, but we do not believe they will be found more efficacious than sodium bicarbonate. If the jaundice does not quickly disappear or diminish in intensity, other remedies may be applied. On the supposition that the duodenal mucous membrane is in a state of chronic catarrh, nitrate of silver has been advised in pill given on an empty stomach. If there should be reason to regard the attack as possibly of malarial origin, it may be necessary to administer quinine or arsenic; or if there be a presumption in favour of a gouty irritation of the bile-ducts, colchicum, in combination with alkalies, will be likely to give relief. Jaundice occasionally occurs in the early stages of syphilis, and requires treatment with repeated doses of mercury, while if there is any reason to suspect gummatous infiltration, iodide of potassium should be given along with mercury.

We may here mention Gerhardt's method of treating obstructive jaundice, which consists in passing a faradic current through the gall-bladder, one pole of the battery being placed on the spine, and the other over the distended gall-bladder—the object being to produce a general contraction of the muscular fibres of that organ. He has seen the gall-bladder diminish greatly in size, and a bilious evacuation follow two such applications.

When the disease tends to become **chronic,** and we are able to eliminate all other possible causes than a chronic catarrhal condition of the bile ducts, we may have to consider other methods of treatment.

In such cases, just as in cases of jaundice from gall-stones, mineral-water treatment at such spas as Carlsbad, Vichy, etc., often proves most serviceable. The movement of travel, the systematic exercise in the open air, the regular bathing, the strictly-prescribed dietary, combine to promote the remedial effects of the warm, saline, alkaline waters. When aperient action is required, Carlsbad or Marienbad is the more suitable, and Vichy is better when no such aperient action is needed. The diluent effect of large draughts of warm alkaline water is, as we have previously pointed out, an obvious remedial agency in these cases. A favourite remedy in some of them, especially in Anglo-Indians, is dilute nitro-hydrochloric acid, both internally and externally. Twenty minims of the dilute acid in 1½ ounces of infusion of calumba may be given three times a day, an hour before meals. For topical use, 3 ounces of nitro-hydrochloric acid should be added to a gallon of water of a temperature of 98° F.; this may be used as a foot-bath, and the legs, arms and abdomen may be sponged with it; or it may be applied to the hepatic and abdominal region by means of a broad flannel roller, soaked and wrung out in the acid.

Two thicknesses of this should be wound round the abdomen, and then covered with oil-silk. It should be worn regularly under the dress and changed morning and evening. Dr. Musser appears to think the prolonged use of nitrate of silver of very great value in these chronic cases.*

We have already mentioned the association of jaundice with swelling of the head of the pancreas: if jaundice persists, in spite of thorough treatment, it will be necessary to consider the propriety of opening the abdomen, with a view to draining the gall-bladder.

The absence of bile from the intestine has usually been regarded as giving rise to symptoms calling for treatment, such as constipation, putrefactive changes and acidity of the intestinal contents, causing distressing flatulence, together with imperfect assimilation of fatty matters. But Mayo Robson concludes from the elaborate study of a case of biliary fistula, in which no bile entered the alimentary canal, that an entire absence of bile from the intestine is quite compatible with good health; that its supposed stimulating aperient effect is not needed, that its *antiseptic* properties are unimportant, and that, although it assists in the absorption of fat, it is not absolutely necessary for that purpose, and that bile, in short, is chiefly excrementitious.† These conclusions are, perhaps, a little too absolute to be based on one observation, for the opposite conclusions, that the absence of bile from the bowel does lead frequently, directly or indirectly, to constipation, to putrefactive decomposition and flatulence, and to disordered digestion and assimilation, are founded on a vast number of observations by a variety of skilled observers.

Certainly, in the practical management of cases of jaundice, we shall have to consider these possibilities. It is desirable, therefore, in these chronic cases, to give simple kinds of food that can be readily assimilated, and that will not leave much residue to undergo putrefactive changes. Milk and light farinaceous foods, with small quantities of the more delicate kinds of fish and chicken, are permissible; but all excess must be carefully avoided, and fatty and saccharine foods prohibited. We have already pointed out the importance of the free exhibition of alkaline beverages when the stomach is empty. To correct intestinal acidity, it is best to give an insoluble alkaline carbonate, such as magnesia, once or twice daily—half a teaspoonful of light magnesia may be given at bed-time every night in a wineglassful of warm water.

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* Hare's "System of Practical Therapeutics" (new edition), vol. ii., p. 462.

† "Gall-stones and their Treatment."

That the absence of bile from the intestine does, in many cases, lead to morbid putrefactive changes in its contents we are satisfied. In order to avoid these changes, various remedies are available, and their employment will usually be found to be attended with great benefit to the patient. A capsule, containing a minim of creasote, or a grain of thymol made into a pill with a little powdered soap and rectified spirit, may be taken after each meal; either of these will be found most valuable in checking the intestinal putrefaction. Bouchard recommends charcoal upon which an ethereal solution of iodoform has been poured. The ether evaporates rapidly, and a mixture of charcoal and iodoform remains; this is an exceedingly disagreeable remedy, which we do not consider more efficacious than the preceding. He has also suggested naphthaline and naphthol. By this means he succeeds in rapidly removing the fœtor of the motions. Inspissated ox-gall (*fel bovinum purificatum*) has been given with advantage in these cases to supply artificially the aperient, digestive, and anti-putrefactive properties of the absent bile. But to be of use it must be *quite fresh*, and 10 grains of this may be given in pills an hour or two after food three times a day. It is best to coat these pills with a coating (such as keratin) soluble in the duodenum, but not in the acid contents of the stomach.

Creasote will be found a useful remedy also when diarrhœa is excited by the acid or putrefying intestinal contents. Whitla recommends large doses of turpentine in capsules for the relief of this symptom, taken when the stomach is empty, so that it may pass through into the intestine and exert its antiseptic action there. Salicylate of bismuth, charcoal, boric acid and cyllin have all been found useful for the same purpose.

We have already insisted on the necessity of administering aperients regularly in all forms of jaundice associated with constipation. An aloetic and soap pill at night, and a draught containing sodium or magnesium sulphate the following morning, will be found one of the best aperients to use in these cases.

In the next place there are certain symptoms, commonly attributed to the presence of bile *in the blood*, which require to be considered; one of the most troublesome is an intense **itching** of the skin. Warm baths or vapour baths, together with friction of the skin while in the baths with alkaline (sodium) soaps, is one of the best means of relieving this symptom. Sponging with weak carbolic lotion (1 : 40) has been found useful. If the irritation is confined to a few localised patches, rubbing the surface with a flat disc of menthol will afford some relief. Warm diaphoretic drinks, together with vapour baths, so as to promote free excretion from the skin, should be given. *Pilocarpine* has been advocated as a most efficient remedy for this symptom, given hypodermically, in doses varying from $\frac{1}{12}$th to $\frac{1}{6}$th of a grain; indeed, Witkowski, whose statement is quoted, and in part approved, by Professor Whitla, has maintained that this is *the* remedy for all cases of simple hepatogenous jaundice. He injects $\frac{1}{6}$th of a grain once or twice daily. Small frequent doses of antipyrin have also met with some success. It is hardly necessary to point out that chill of the skin should be carefully guarded against by wearing thoroughly warm clothing.

Other symptoms attributed to the presence of the colouring matter of the bile in the blood are depression of the circulation, as indicated by slowing of the pulse rate, and a tendency to hæmorrhages, as well as great depression also of the intellectual functions, with drowsiness and hypochondriasis. To relieve these we must promote the natural efforts at elimination, mainly carried on by the kidneys, but which may be aided by stimulating the respiratory functions. Frerichs insisted on the importance of increasing or maintaining the activity of the respiratory functions for the purpose of promoting the oxidation and destruction of the bile pigment, and for this purpose, when the patient is able to do so, we should encourage him to take much exercise in the open air, and to combine with this such gymnastic exercises as are within his strength and competence. It is our business also to favour the eliminative action of the kidneys. One of the best diuretics for this purpose is an abundance of pure water, or milk largely diluted with warm water, or whey may be advantageously used if milk shows any signs of disagreeing. Vichy, Ems, or Apollinaris water may be largely given, mixed with warm milk or whey. Potassium iodide, combined with potassium bicarbonate, 5 to 10 grains of each in a wineglassful of warm milk and water, may be given as a diuretic thrice a day. Imperial drink—or effervescing lemonade, made with lemon-juice and potassium bicarbonate—may be freely given.

Great circulatory and mental depression may require the use of tonics and stimulants. Digitalis has been suggested, but its administration is rarely appropriate. Quinine and strychnine, combined with ammonia or with nitro-hydrochloric acid, according to circumstances, will be found the best tonics. The light effervescing wines (champagne, hock, moselle) often act freely as diuretics when diluted with some alkaline table water, and may be found useful in raising the forces of the patient when they are greatly depressed. Travel and the distractions it affords have been thought useful in warding off the mental and physical depression so distressing in protracted cases.

In cases of obstructive jaundice from organic stricture of the duct, or from pressure on it by malignant or other tumours, the remedies mentioned here can, obviously, only be palliative in their effects. In some of these cases surgical operation may be of use, as we have pointed out when dealing with the treatment of obstruction from impacted calculus.

There is also a *jaundice of new-born children*—of uncertain origin, with staining of the conjunctivæ and skin with bile pigment, attended by the passage of bile-stained urine. There is a *benign* form which is very common, and will often get well without any treatment. The most that is necessary to hasten the disappearance of the jaundice is a mild aperient with a little sodium bicarbonate; $\frac{1}{20}$th grain of calomel or $\frac{1}{4}$ grain of grey powder, with 2 or 3 grains of sodium bicarbonate, may be given twice or thrice daily. There is also a *grave* form which is rare, and may be due to congenital obliteration of the gall-ducts or to septic infection through the umbilicus (umbilical phlebitis). The poison may be derived from the maternal passages. These cases are almost invariably fatal; the proper treatment in septic cases is that which would be applicable to other septic states.

ADDITIONAL FORMULÆ

Pills to promote flow of bile in catarrhal jaundice

℞ Extracti aloes, ʒss.
Sodii bicarbonatis, ʒj.
Extracti taraxaci, q.s.

Ut f. pil. lx. (To be kept in lycopodium powder.) Two night and morning.

(*Bamberger.*)

Or

℞ Extracti aloes aquosi, ʒj.
Extracti rhei compositæ, ʒss.
Extracti taraxaci, q.s.

Ut f. pil. lx. Three pills night and morning.

(*Bamberger.*)

Mixture in jaundice

℞ Succi taraxaci, ℥ij.
Sodii bicarbonatis, ʒvj.
Tincturæ rhei, ℥jss.
Infusi gentianæ ad ℥xij.

M. f. mist. A tablespoonful three times a day. (*Whitla.*)

Pills in catarrhal jaundice

℞ Felis bovini purificati, ʒj.
Manganesii sulphatis exsiccatæ, gr. xl.
Resinæ podophylli, gr. v.

M. et divide in pil. xx. One three times a day. (*Bartholow.*)

For the pyæmic jaundice of the new-born

℞ Quininæ sulphatis, gr. jss. ad iij.
Acidi sulphurici diluti, ♏iij.
Syrupi aurantii, ʒijss.
Aquæ destillatæ ad ℥ijss.

M. f. mist. A teaspoonful every two hours. (*Widerhofer.*)

For acute catarrhal jaundice

℞ Liquoris ammonii acetatis, ℥v.
Spiritus ætheris nitrosi, ℥j.
Tincturæ radicis aconiti, ♏xxj.

M. A tablespoonful every three hours in half a tumblerful of lemonade or Apollinaris. (*Engel.*)

Pills in malarial jaundice

℞ Quininæ sulphatis, gr. xl.
Ferri sulphatis exsiccatæ, gr. xx.
Acidi arseniosi, gr. j.

M. et divide in pil. xx. One three times a day. (*Bartholow.*)

Aperient pills in jaundice

℞ Aloes socotrinæ, gr. xv.
Gambogiæ, gr. xv.
Hydrargyri subchloridi, gr. xv.
Syrupi, q.s.

M. et divide in pil. x. One or two a week to keep the bowels loose. (*Gubler.*)

CHAPTER III

TREATMENT OF CONGESTIVE AND INFLAMMATORY AFFECTIONS OF THE LIVER. 1. HYPERÆMIC CONDITIONS. 2. ACUTE SUPPURATIVE HEPATITIS, ABSCESS OF LIVER. 3. CHRONIC INTERSTITIAL HEPATITIS, CIRRHOSIS

1. *Hyperæmic Conditions of the Liver.*—Causes of Active Congestion— "Free Living"—"Liver-chills"—Malaria—Gout—Suppression of Habitual Discharges—Symptoms. *Indications for Treatment*—Diet and Regimen—Counter-irritation—Aperients—Alkaline Effervescents. *Treatment* of Chronic Cases—Value of Courses of Mineral Waters and Hydrotherapy. Passive Congestion—Causes—*Treatment.*
2. *Acute Suppurative Hepatitis, Abscess of Liver*—Causes of Multiple Abscesses—No special Therapeutic Indications—Tropical Hepatic Abscess—Etiology. Symptoms—Pyrexia—Pain—Swelling—Fluctuation—Characteristic Aspect—Results. *Treatment*—Ipecacuanha, Morphine, etc.—Preliminary Puncture and Aspiration—Free Incision and Drainage—Modes of Procedure.
3. *Chronic Interstitial Hepatitis, Cirrhosis.*—Its Nature—Causes—Alcohol, etc.—Varieties—Hypertrophic or Biliary Cirrhosis. Symptoms of Ordinary Atrophic Cirrhosis—Gastro-intestinal Catarrh—Hæmatemesis—Ascites—Slight Jaundice—Hæmorrhoids—Toxic Symptoms. *Indications for Treatment*—Diet—Milk—Aperients—Courses of Mineral Waters—Alkalies—Intestinal Antiseptics—Nitro-hydrochloric Acid—Treatment of Hæmatemesis, Bleeding Hæmorrhoids, and Ascites—Propriety of Tapping—Mode of Operation—Talma-Morison Operation—Diuretics and Purgatives—Potassium Iodide—Ammonium Chloride—Tonics—Treatment of Varieties. Additional Formulæ.

1. Hyperæmic Conditions of the Liver

Congestion of the liver is a term of very frequent use, but its signification is not always very definite and precise. It doubtless is often assumed to exist when it does not, and it is offered as an explanation of certain vague dyspeptic and other symptoms, without any positive evidence, from physical examination, of the existence of a morbid state of the liver.

It would, however, be a serious error to ignore the frequent existence of temporary as well as chronic morbid congestions of the liver, simply because this term is so vaguely, and often inaccurately, employed.

Hyperæmic conditions of the liver may be either (*a*) *active* or *fluxionary*, or (*b*) *passive* or *congestive;* and we commonly speak of these states as *active* or *passive* congestion.

The amount of blood in the liver varies considerably within physiological limits, and there is a transient congestion of this organ after each meal. Rapid absorption by the portal vessels raises the lateral pressure in the portal venous system and causes a *fluxion* to the liver. Habitual excessive indulgence in food and drink may, and doubtless does, intensify this fluxion and produces active hyperæmia or congestion of the liver which, in course of time, leads to functional disturbances of this organ. The excessive consumption of alcohol, especially in the form of ardent spirits, is well known to lead to serious organic changes in the liver, as we shall presently see; but short of these serious organic changes, the habitual free use of alcoholic stimulants, together with a liberal consumption of food, is especially prone to induce such conditions of active congestion of the liver as we are now considering. One of the effects of the alcohol conveyed to the liver by the portal veins is no doubt to cause dilatation of its capillaries, and so to contribute directly to hyperæmia of this organ. Frequently recurring hyperæmias will naturally lead, in course of time, to permanent dilatation of the vessels.

Occasional over-indulgence in food and drink may lead to temporary congestion of the liver, of no great consequence, but habitual over-indulgence may lead to more permanent hyperæmia, which may require more serious consideration. It is clear that what is called "free living" tends to maintain active hepatic congestion.

It has been the custom of late years to speak of **"liver-chill,"** a condition which we should be disposed to place under the head of active febrile congestion of the liver, and which would appear to be capable of being produced by exposure to chill in certain other favouring circumstances, one of the chief of which would seem to be over-work and anxiety, and perhaps the possession of what is called a gouty constitution. In such circumstances, in certain constitutions, evidences of hepatic engorgement occur, with some enlargement and tenderness of that organ; this is usually accompanied by a moderate rise of temperature, and is often associated with symptoms of gastro-intestinal catarrh, and not rarely with slight jaundice, viz. bile-tinted conjunctivæ, pale motions and high-coloured urine, headache, languor, and physical and mental prostration.

We must add, then, exposure to cold in certain circumstances, to the causes of active hepatic congestion.

It is possible that the chronic hyperæmic conditions of the liver, which arise so commonly in Europeans who have to reside in tropical countries, may be closely allied to those states of "liver-chill" which occur in Great Britain, and may be, in part, dependent on chill supervening after exposure to great heat. But it is usual to regard these morbid states of the liver, arising in tropical countries, as dependent on exposure to malarial or other toxic influences.

Certain constitutional states, such as the gouty diathesis, are generally admitted to predispose to attacks of active congestion of the liver, perhaps by the agency of toxines absorbed from the intestine. Prof. Bouchard has stated that he has observed dilatation of the stomach to be always accompanied by congestion of the liver, which he regards as produced by the passage into the portal veins of toxic substances derived from the abnormal decomposition of the contents of the dilated stomach. Active congestion of the liver has also been observed to follow the suppression of the menstrual flow or that of a hæmorrhoidal flux.

The **symptoms** of active congestion of the liver are sometimes those which we have mentioned under "liver-chill," but in other instances, and especially in the chronic forms, they usually consist of a sense of fulness or weight or constriction in the hepatic region, with pain or tenderness over the liver, where it escapes from the protection of the ribs, as will be found by percussion and palpation. There is also pain under the right shoulder, and often there are present the symptoms of chronic gastric catarrh, such as pain and fulness after food, flatulent distension, loss of appetite, a coated tongue, constipation (sometimes slight diarrhœa), high-coloured urine depositing lithates, headache, lowness of spirits and general malaise.

The **indications for treatment** in most cases of active hyperæmia of the liver are tolerably clear, and when thoroughly and honestly carried out, prove highly remedial.

The first and most important is to correct all errors of **diet** and faulty habits of life. The over-fed, indolent person must be made to take less food and more exercise. Those prone to indulge in alcoholic stimulants must be induced to forego this indulgence, and to be content with other beverages. When over-work and too close application to business or public affairs are at the root of the evil, rest and change must be insisted upon. Courses of mineral waters at Continental spas are, as we shall presently see, most useful in many of these cases, and they are not only useful in themselves, but they are also of great value from the necessity they involve of change and rest from habitual occupations. In the *febrile* cases, the cases of "liver-chill," the indication is to relieve the hepatic engorgement and the gastric catarrh usually associated therewith by a few days' *rest* in bed, by light, unirritating food, by counter-irritation, and by unirritating aperients and alkalies.

Counter-irritation over the region of the liver is undoubtedly of great value—the application of leeches, advised by some, we do not consider called for save in very exceptional cases—a large hot linseed and mustard poultice all over the right hypochondrium and the epigastric region will often be found of great service to the patient, and, when removed, should be succeeded by a thick layer of warm cotton-wool. The food should consist at first almost exclusively of fluids—milk and Apollinaris water, thin gruel, water arrowroot, light mutton or veal broth, a little light clear soup, weak tea with milk. After the feverish symptoms have passed away, some boiled fish (sole or whiting), and chicken and rice, or white game, or similar light food may be prescribed.

The hepatic congestion will certainly be favourably affected by draining, as it were, fluid from the portal vessels by means of suitable aperients, which will also at the same time unload the bile channels; for this purpose we should give a small dose of calomel, half a grain or a grain, at night, and a saline aperient draught the following morning—1 to 2 drams of sodium sulphate or magnesium sulphate, with 20 grains of sodium bicarbonate, in 2 ounces of warm water; or, with delicate persons who require a very mild and pleasant aperient, we may order 3 ounces of Dinneford's fluid magnesia, with a teaspoonful of lemon juice. During the day, an hour or half an hour before each meal, an effervescing saline dose, with a considerable excess of alkali, will be grateful and most useful to the patient. It relieves the tendency to nausea, allays thirst and "heat of stomach," and promotes the flow of thin bile into the intestine. The following is a good form:—

℞ Sodii bicarbonatis	ʒiij.
Ammonii carbonatis	ʒss.
Aquae	ad ℥vj.

Misce, fiat mistura alkalina.

℞ Acidi citrici ... ... ʒi-s.
Syrupi limonis ... ... ʒvj.
Aquæ ... ... ad ℥vj.

Misce, fiat mistura acida. Two tablespoonfuls of each mixture to be mixed together and drunk while effervescing an hour before each meal.

If the hepatic congestion is associated with suppression of the menstrual flow, leeches to the os uteri and the application of cupping glasses or mustard poultices to the inside of the thighs have been advocated; and if dependent on the arrest of a hæmorrhoidal flux, leeches may be applied to the anus; but cases of this kind are rarely encountered.

For the **chronic** cases a different plan of treatment will be required. Instead of rest, free exercise in the open air, when possible, should be almost invariably urged. When this is impracticable, one of the numerous systems of indoor medical gymnastics may be advised. A careful, spare dietary should be insisted upon. Exposure to chill should be guarded against by warm clothing, and by the wearing of a broad flannel or woollen abdominal band, such as is habitually worn by many who have lived in tropical climates. Counter-irritation over the hepatic region may still be useful.

Regular and free action of the bowels by means of aperients will usually be necessary and beneficial. A euonymin (2 grains), aloes ($1\frac{1}{2}$ grains), and ipecacuanha ($\frac{1}{2}$ grain) pill at night, followed by one or two teaspoonfuls of Carlsbad or Homburg salts, in half a glass of hot water, the following morning, will be found efficacious in most cases. Fractional doses of calomel ($\frac{1}{20}$ grain) three times a day, or of the perchloride ($\frac{1}{32}$ grain) are valuable as promoting intestinal antisepsis.

But it is in these cases of chronic congestion of the liver that spa treatment proves so useful. A considerable choice may be afforded, and a selection made according to individual peculiarities or needs. Carlsbad, Marienbad, Kissingen, Tarasp, Brides, Vichy, Harrogate, Leamington, may prove efficacious in suitable cases.

Hydrotherapeutic treatment has also proved of great service, especially in malarial cases and in cases dependent on excesses in food or drink.

Passive hyperæmia or **congestion** of the liver is a common consequence of all those morbid states of the heart or lungs, or other intrathoracic disease, which lead to stasis of blood in the right side of the heart; and, owing to the very feeble lateral blood-pressure in the hepatic veins, only a slight obstruction is necessary in order to lead to more or less passive engorgement of the liver. Congestion of the liver is a usual consequence, and a regular feature in the clinical course, of chronic valvular cardiac disease, of advanced emphysema of pulmonary fibrosis, and of any condition of the lungs or the thoracic contents which interferes with the free outflow of blood from the right side of the heart. The term "cardiac liver" is one in common use to express that state of chronic passive hyperæmia of the liver, and the structural changes it leads to, as a consequence of cardiac disease; and the familiar term "nutmeg liver" is applied to the appearances presented on sections of such a liver post mortem.

The liver may enlarge very considerably from hyperæmia of this kind, and the liver dulness may reach to the umbilicus or even below it. It is in circumstances such as these that "hepatic pulsation" may sometimes be detected, the whole organ throbbing at each cardiac contraction from the backward flow of blood into the hepatic veins.

We have already called attention to the symptoms attending this condition, and the treatment indicated, when dealing with the subject of chronic mitral valve disease, of which it forms a part—the gastro-intestinal catarrh, the occasional hæmatemesis, the occurrence of ascites and general dropsy, the slight jaundice, the pale motions, and the high-coloured scanty urine containing biliary pigment.

In remediable cases, cardiac tonics, such as digitalis, together with rest in bed, may remove the hepatic engorgement by remedying the cause on which it depends. The time-honoured combination of powdered digitalis leaves, powdered squill, and blue pill, one grain of each, in form of pill, three times a day, is very serviceable. The value of free purgation we have repeatedly insisted upon to relieve the congestion of the abdominal veins. The food must be nourishing but light, and pre-digested or very digestible, and small in quantity.

In cases of intense hyperæmia it has been suggested that the liver should be punctured, and 18 or 20 ounces of blood withdrawn by aspiration. No doubt this measure might reduce, temporarily, the size of the liver, but in most of the conditions which lead to hepatic congestion of this extent the loss of blood is badly borne, and the benefit derived would be only of very brief duration. Moreover, it is a dangerous procedure, and has several times led to fatal hæmorrhage from wounding of a large vein. Sufficient relief can be safely obtained by the free local application of leeches, followed by a succession of hot fomentations, to encourage the bleeding.

2. ACUTE SUPPURATIVE HEPATITIS, ABSCESS OF LIVER

Suppurative inflammation of the liver is met with in two forms: (1) *Septic* and *pyæmic* abscesses, and (2) the *large solitary* and *tropical abscess.*

The first form is almost invariably multiple except in some traumatic cases, when a large solitary abscess may sometimes be met with; they are always the result of septic, microbic, infective inflammation. They are prone to occur in cases of general pyæmia, and especially in conditions of *portal* pyæmia, when suppurative disease occurs in the region of the portal vessels, as in dysentery, typhlitis, appendicitis, ulcerative colitis, anal fistula, gastric ulcer, etc.

Multiple hepatic abscesses may also occur in connection with suppuration of the bile-ducts from impacted calculus (*infective cholangitis*); the treatment of this form is purely surgical.* When multiple infective abscesses are found, as they often are, within the branches of the portal vein, this condition is known as *suppurative pylephlebitis.* In these cases there is uniform enlargement of the liver, which is tender on pressure; there is pyrexia, which runs an irregular course, as in pyæmic jaundice; the complexion is muddy, and often bile-tinted. There are no clinical distinctions between pyæmic abscesses and suppurative pylephlebitis, their symptoms and features are those of pyæmia, with the addition of an enlarged and painful liver and a subicteroid hue of the skin. There is *no special treatment* of this state apart from that of the general or local infective disease from which it arises. Surgical interference is generally useless, as these cases almost invariably end fatally, but there could be no objection to puncturing an abscess which pointed externally.

Having dismissed these cases of multiple septic hepatic abscesses, we will now consider the more interesting subject, from a therapeutic point of view, of the treatment of the **large "solitary" tropical hepatic abscess.** Tropical abscesses are not, however, always solitary, although they frequently are so; nor are solitary large abscesses of the liver (so-called *primary* hepatic abscess) confined exclusively to tropical countries. They are very common, no doubt, in hot climates, but they do occur, though rarely, in England and other regions outside the tropics, but in temperate climates abscess of the liver is invariably *secondary.* We have more than once met with a large solitary abscess of the liver in connection with suppuration about the appendix.

It is an interesting fact that hepatic abscess is very rarely found in cases of bacillary dysentery, or of the so-called "asylum dysentery," as it occurs in this country.

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* *See* Mayo Robson's "Diseases of the Gall-Bladder and Bile Ducts" (3rd edition), p. 80.

It has been debated whether abscess of the liver, even when it occurs in tropical countries, is ever really "*primary*," whether, in short, it is not always due to secondary infection from dysenteric ulceration, or some other infective condition in the intestinal canal. That it very frequently follows or is associated with amœbic dysentery is universally admitted. Many medical men, however, who have had extensive experience in India, believe that abscess of the liver may develop "*idiopathically*," and it seems to be agreed that cases certainly do occur without a history of previous dysentery, and that fatal cases have been met with where there has been no discoverable affection of the large intestine.

In the interesting researches on amœbic dysentery of Councilman and Lafleur,* it is suggested that the *amœbæ coli* (which they consider to have been proved to be the causative and characteristic organism of tropical dysentery) are carried to the liver by the portal vein and there produce dysenteric abscesses. "Of themselves the amœbæ can only produce a certain amount of injury, by tearing the capillaries, the agents which produce the abscesses being the (pyogenic) bacteria which are carried within the bodies of the amœbæ from the intestinal canal to the liver."

These amœbæ have been found in abundance in the stools of dysenteric patients, also in the dysenteric ulcers, and abundantly in the pus of hepatic abscesses, and in the sputum in those cases where a hepatic abscess has opened into the lung. These observers examined the pus in four liver abscesses in cases where there was *no* dysentery, and they did not find any amœbæ. Three of the cases recovered after operation, and in the fourth, fatal case, an ulcer was found in the rectum. "Whether," they add, "the three patients who recovered were suffering from latent dysentery or not must remain a matter of conjecture."

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* *Johns Hopkins Hospital Reports.* Baltimore. Vol. ii., Nos. 7, 8, 9.

In reported cases of tropical hepatic abscess *without* intestinal lesions, no search being made for amœbæ, it is impossible to say whether they were present or not. "If they all are produced by the amœbæ, it is possible that they enter the liver without producing any intestinal lesions."* Further researches are needed and will doubtless be made in this direction.

Cases of hepatic abscess, as observed in Great Britain, usually occur in persons who have returned from a residence in the tropics, or who have contracted dysentery in India; instances are, however, on record of typical solitary hepatic abscess in patients who have never been out of England: in these cases various pus-producing organisms have been found.

The **symptoms** of hepatic abscess are sometimes *latent*, and instances are recorded of sudden death from rupture of hepatic abscess, the existence of which was not suspected: usually, however, this disease is accompanied by a characteristic group of symptoms and physical signs.

Pyrexia, of an irregular, intermittent, septic type, usually exists. The temperature, after being normal or subnormal for two or three days, will rise, with a rigor, to 103° Fahr., or higher; or there may be a daily afternoon rise, without rigor. Profuse perspirations are common. These symptoms sometimes lead to the disease being regarded as malaria. There is *pain* of a dull, aching character in the right hypochondrium, extending to the shoulder, and there is tenderness on pressure over the liver. Enlargement of the liver can usually be made out, most marked, however, in the majority of cases, in the right lobe and extending upward, and to the right, as the abscess cavity is more commonly nearer the upper than the under surface.

If the liver enlargement is great, as it often is, the right side may be considerably bulged, and the edge of the liver may be felt 3 or 4 inches below the costal margin. Fluctuation may sometimes be detected. Sometimes adhesions form, and the abscess points below the ribs, in the epigastrium. The peculiar aspect of the patient is considered to be suggestive, if not characteristic, of hepatic abscess: the face is pale, the complexion muddy, the skin sallow or with a subjaundiced hue, the conjunctivæ are swollen and bile-tinged. If diarrhœa is present, the stools should be examined for amœbæ.

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* Councilman and Lafleur.

It is not very uncommon for the abscess to rupture into the pleura. Sometimes it invades the lung, "the extension may occur through the diaphragm, without actual rupture and with the production of a purulent pleurisy and invasion of the lung," attended by severe convulsive cough and reddish-brown expectoration of a brick-dust colour, resembling anchovy sauce, in which *amœbæ coli* have been found, identical with those in the liver abscess and the stools. They displayed active amœbic movements.*

An abscess of the liver may also rupture into the peritoneum or pericardium and be immediately fatal, or into the stomach, duodenum, or colon, and the pus be vomited or discharged by the bowel. The most favourable results seem to follow spontaneous discharge through the lung, and next through the stomach and intestine.

The **treatment** of abscess of the liver must be mainly surgical. Many Anglo-Indian physicians describe forms of acute hepatitis, in what has been termed the pre-suppurative stage, a pathological condition evidenced by a marked leucocytosis, with persistent intermittent fever, and they maintain that such cases, with symptoms precisely like those of hepatic abscess, often recover quickly, under the exhibition of ipecacuanha in doses of 15 to 20 grains every five, six, or eight hours, while, at the same time, morphine is administered hypodermically to relieve the pain, and hot fomentations and poultices are applied locally. It has been remarked with regard to this statement, that it is impossible to be certain that suppuration would have occurred in these cases if left to themselves; but it may be said, on the other hand, that, assuming ipecacuanha to contain a principle which has the power of destroying the activity of the *amœbæ coli*, and supposing this principle to be soluble in the intestinal contents and to be carried to the liver through precisely the same channels as the toxic irritant, and supposing this irritant to be of only feeble virulence, there seems nothing irrational or impossible in the hypothesis that its infective potency may be stayed, and the pathological processes which might otherwise end in suppuration abated.

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* Osler's "Principles and Practice of Medicine" (4th edition), p. 580.

Puncture of the liver is sometimes practised with a view to preventing suppuration, and has met with some success, but it is a risky procedure, and in our opinion should not be resorted to. The general treatment of the condition should pursue the same lines as those indicated in acute congestion of the liver.

But when the diagnosis is clearly established of the existence of hepatic abscess, operative procedures should at once be undertaken. In order, however, to make this diagnosis certain, preliminary exploratory or aspiratory punctures, under general anæsthesia, are often needful. It is best to combine aspiration with puncture, for sometimes the pus is so thick that, without aspiration, it will not flow through the cannula. Aspiration is not free from risk: a leakage of pus may infect the peritoneum; or severe and even fatal hæmorrhage may result from wounding a large bloodvessel in the liver. Cases are also reported in which the stomach or intestine has been wounded. For these reasons, whenever the existence of an abscess is certain, and the physical evidences render its localisation easy, it is well to forgo preliminary aspiration and proceed at once to open the abdomen for the purpose of free incision and drainage.

Since hepatic abscesses have been treated by free incision and drainage, the mortality, according to Dujardin-Beaumetz, has fallen from 80 to 32 per cent.

Leonard Rogers holds that in tropical countries the dangers of open incision far outweigh those of aspiration, on account of the admission of secondary pathogenic organisms into a cavity the contents of which he has shown to be sterile, but for amœbæ, in 80 per cent. of cases. He recommends "removal of the collection" of pus by aspiration without the admission of the external air, and repeated irrigation with quinine (the soluble bi-hydrochloride in a strength of 3 to 5 grains to the ounce), or other amœba-destroying solutions.* He has devised a flexible-sheathed aspiration cannula which can be used for syphon drainage and irrigation. Open incision he would reserve for those cases in which the pus, withdrawn by aspiration, is shown to contain septic micro-organisms.

3. CHRONIC INTERSTITIAL HEPATITIS, CIRRHOSIS, GRANULAR OR "HOB-NAILED" LIVER

This is a form of chronic or subacute hepatitis affecting the smaller branches of the portal vein and the surrounding connective tissue, and resulting in a considerable proliferation of this tissue by production of young connective tissue elements from those already existing. At the same time, the irritant, whatever its nature may be, causes degeneration of the essential cells of the liver. Cicatricial contraction of this new connective tissue leads to obstruction and obliteration of the branches of the portal vein, and of the bile-ducts also to a certain degree.

Essentially, then, in its most typical form, this disease consists in degeneration of the liver cells and irritative or inflammatory overgrowth of connective tissue, which, in the contraction it afterwards undergoes, obstructs the portal circulation and still further destroys the liver cells. In this typical so-called *atrophic* form the liver often becomes greatly diminished in size, firm, hard, fibrous, and resistant, but in very many cases and in the early stage of all cases the liver is usually increased in size. On section "the substance is seen to be made up of greenish-yellow islands, surrounded by greyish-white connective tissue." The name "cirrhosis" was given to this disease by Laennec, on account of this yellow colour seen on section.

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* *Lancet*, August 15, 1908, p. 483.

This form of interstitial inflammation appears to be usually caused by the passage into the blood of the portal vein of some irritant, which is carried to the liver and there sets up the destructive and proliferative changes already described. There is reason to believe that in some cases the poison may come to the liver by the hepatic artery from the general circulation.

Until recent years the irritant was generally believed to be in almost all cases **alcohol**, and particularly in the form of strong spirits, not much diluted and taken without food; hence the names "gin-" or "spirit-drinker's" liver. But although unquestionably alcohol is an almost invariable antecedent of cirrhosis of the liver of portal type, the whole body of experimental evidence goes to show that alone it does not produce cirrhosis. It may be that alcohol makes the liver unduly susceptible to the influence of toxines with which in normal health it is able to cope; or perhaps by exciting persistent gastro-intestinal catarrh it leads to an overwhelming invasion of the liver by toxines, bacterial or other. Various substances may, possibly, have the same effect, such as rich, highly-seasoned food, or the absorption of ptomaines or other animal alkaloids from the alimentary canal.

It occurs far more frequently in males than in females, and in middle- and after-life than in youth. Its occasional occurrence in childhood has been advanced in proof of the existence of a non-alcoholic form, but many of these cases can also be traced to alcohol or some other irritating ingesta; a few, however, appear to be traceable to an acute interstitial hepatitis, set up by scarlet fever or other infective disease. Syphilitic and malarial forms are also recognised. We have already alluded to the hyperæmic "cardiac liver" which so frequently accompanies chronic heart disease; wasting of the central cells of the hepatic lobules, and hyperplasia of the connective tissue may occur in this form and so produce a spurious cirrhotic condition.

Much attention has recently been directed to the fact that the liver is not diminished in size in all cases of cirrhosis. Even in the typical atrophic form there is moderate increase of size in the early stage, chiefly due to hyperæmia. There is also a form which has been described as "*fatty cirrhosis*," and this, according to Osler, is quite as common in America as the atrophic variety. The liver is "enlarged, smooth or very slightly granular, anæmic, yellowish-white in colour, and resembles an ordinary fatty liver. It is, however, firm, cuts with resistance, and microscopically shows a great increase in the connective tissue." It is most common in beer drinkers. The form associated with *perihepatitis* cannot be distinguished clinically from the atrophic form.

Much has been written on the subject of *hypertrophic cirrhosis*, and this term has probably been applied to a variety of conditions; its clinical characters were first described by French writers, and especially by Hanot, and from its supposed origin about the bile-ducts it has been termed *biliary* cirrhosis. This type is generally regarded as of infectious origin, and not necessarily associated with the ingestion of alcohol. Whether the poison reaches the bile-ducts in the blood, or by ascending infection of the bile-ducts from the duodenum, is obscure, but the early and marked enlargement of the spleen would suggest that the virus is in the blood. It will be sufficient here to say that this form is characterised by permanent enlargement of the liver and spleen. The bile-ducts are "the seat of the angiocholitis, catarrhal and productive, and there is an extraordinary development of new biliary canaliculi";* the main disposition of the new connective tissue is monolobular. The surface, unlike that of the atrophic form, is smooth; "it is exceedingly firm, resists cutting, and presents on section a deep greenish-yellow colour." The chief clinical differences between the hypertrophic "biliary" and the atrophic form are that in the former there is *persistent jaundice*, which may be intense, although the stools are bile-stained; and there is an absence of *ascites*. It may run a very chronic course (4 to 6 or even 10 years), and is apt to terminate with the symptoms of acute febrile jaundice. "The patient may present every feature of acute yellow atrophy," the sole diagnostic criterion being the enlargement of the liver. Dieulafoy maintains that there are "mixed" cases, and that the two forms run into one another.

To return to the common type of so-called atrophic cirrhosis and its symptoms. These depend on the two essential elements of the disease: obstruction to the portal circulation and destruction of liver cells. It is remarkable that the most extreme degree of atrophic cirrhosis may occasionally exist without symptoms, owing to the establishment and maintenance of a collateral compensatory circulation of complete efficacy. This takes place through anastomosis between rootlets of the portal veins and those of the general venous system; between those of the œsophagus and stomach, and between the rectal and iliac veins; and much of the blood of the portal vein doubtless also gets into the veins of the abdominal wall, and through them into the internal mammary veins.

But the establishment of such a complete compensatory collateral circulation as this is extremely rare, and **symptoms**, due to engorgement of the tributaries of the portal vein, are prominent. The earliest to appear are those due to gastro-intestinal catarrh, to which the habit of spirit-drinking may have, directly as well as indirectly, contributed—a tremulous and furred tongue, nausea, and vomiting, especially on getting up in the morning, loss of appetite, flatulence, irritability of bowels, and sleeplessness. Congestion of the stomach often leads to hæmatemesis, which may be profuse and repeated. It is followed by melæna. The spleen is usually also enlarged. The enlargement of the spleen is probably a hyperplasia due to the action of toxines: these will, of course, exert a more potent influence in a stagnant blood-stream. Greatly enlarged superficial veins may often be seen over the abdominal and lower thoracic regions. In the later stages ascites often supervenes, and with it some œdema of the feet, but general dropsy is rare. Slight jaundice may appear in a certain proportion of the cases, but it is more frequently absent. The urine is scanty, loaded with urates, and sometimes contains a little albumen. Hæmorrhoids are often present.

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* Osler's "Practice of Medicine" (4th edition), p. 574.

Ascites, when it occurs, is probably the combined product of venous stasis and portal toxæmia. In uncomplicated cirrhosis it is a late event, which precedes by no long time the fatal termination. In those cases in which ascites occurs early, and is repeatedly relieved by tapping the abdomen, chronic peritonitis is nearly always associated with the cirrhosis of the liver.

A slight rise of temperature has been noted in some cases. The aspect of the patient is often characteristic; he is thin and ill-nourished, with watery conjunctivæ, sunken eyes, muddy icteroid complexion, and distended venules (stigmata) on the nose and cheeks. In the early stage the liver will be found enlarged and tender. When ascites is present it will be difficult to examine the liver, but after removal of the fluid the rounded edge of the liver may be felt, with its surface hard, firm, and granular.

The preceding symptoms are due to portal obstruction. *Toxic* cerebral symptoms may also develop at any period, noisy delirium or stupor, coma and convulsions. What particular toxic agent produces these symptoms is as yet undetermined; they are analogous to those of uræmia arising in connection with renal disease, for which they have sometimes been mistaken.

With this brief preliminary account of the nature, causation, and symptoms of hepatic cirrhosis before us, we may now be able to formulate some rational **indications for treatment**. In the *first* place, there is the *causal indication*, *i.e.* the avoidance of all alcoholic or other irritating ingesta. *Secondly*, there is the indication to relieve the symptoms of co-existing gastro-intestinal catarrh, due in part to the alcohol, and in part to the obstruction in the portal vessels. *Thirdly*, there is the indication to lessen the portal engorgement by whatsoever means we can safely employ for that purpose. *Fourthly*, there is the indication to relieve urgent symptoms that may arise, such as hæmatemesis and ascites. *Fifthly*, there is the indication to relieve blood contamination (toxic symptoms) arising from the interference with the functions of the liver. And *sixthly* and lastly, there is the indication to endeavour to maintain the nutrition of the body and to support the strength of the patient in a disease in which both are gravely compromised. Let us now see how we are to fulfil these indications.

1. In the first place, the diet must be most strictly limited to such foods and beverages as are absolutely unirritating and easy of digestion and assimilation. Although it may be needful in *advanced* cases to give small quantities of dilute alcohol to maintain the patient's strength, in *early* and remediable cases all forms of alcohol should be entirely forbidden.

An *exclusive milk diet* has been advocated by many physicians as of the greatest value in arresting the progress of this disease. Whitla, in Ireland, has found buttermilk a most useful food. Without limiting the patient absolutely to milk, we would strongly recommend that it should be made the chief article of diet, and in cases in which it is not well borne, if given pure and by itself, it should be mixed with an equal quantity of some alkaline water, such as Vichy, Vals, or Apollinaris; or, with patients who cannot afford these waters, 10 or 15 grains of sodium bicarbonate should be added to each tumblerful of warm or hot milk and water. Equal parts of milk and thin oatmeal gruel, hot or cold, make a very nourishing and pleasant drink. Or the milk may be boiled and thickened with arrowroot or isinglass, so that when cold it forms a jelly, and this may be eaten with a dry biscuit. Milk soup, made by adding to hot milk some well-cooked fresh vegetables and flavouring with celery salt, or some Spanish onion, or thickening with vermicelli or macaroni, is a good variation of the monotony of milk diet. Well-cooked, fresh vegetables and fruit may be allowed in moderation. All fats and saccharine foods should be forbidden, and animal food generally, if not wholly proscribed, should be reduced to a minimum, and the most delicate kinds alone permitted, such as a little boiled chicken, or boiled or grilled sole or whiting.

In advanced cases, where no hope of any great or permanent amelioration can be entertained, and where it is chiefly a question of maintaining the rapidly-diminishing strength of the patient, we may be obliged to give nourishing animal broths and jellies, and such stimulants as champagne or brandy with some effervescing water.

2. A diet such as has been indicated will contribute greatly to the relief of the symptoms of gastro-intestinal catarrh, which are amongst the earliest indications of the existence of this disease; but we have also at our service medicinal measures of no mean utility. One of the most serviceable is the regular depletion of the engorged portal vessels by suitable aperients. A pill of $\frac{1}{6}$th or $\frac{1}{8}$th of a grain of podophyllin (or 2 grains of *iridin*), with 1 to 2 grains

of extract of aloes, a grain of soap, a little oil of peppermint or caraway, should be given every other night, and 1, 2, or 3 drams, according to the sensitiveness of the patient to aperients, of Carlsbad salts, in half a tumblerful of hot water, should be given the first thing every morning. This, in the early stages, will relieve the hepatic congestion, and probably thereby arrest the progress of the disease, while, in more advanced cases, it unloads the abdominal veins, prevents or postpones the occurrence of hæmatemesis and ascites, sweeps away the decomposing residue of imperfect digestion, and so avoids blood contamination or distressing flatulent distension.

Much the same effects are produced by courses of mineral waters, such as the courses at Carlsbad, Marienbad, Kissingen, Tarasp, and Brides, and in some cases such milder courses as Vichy, Ems, or Neuenahr. Warm alkaline waters, such as these latter, undoubtedly exercise a favourable influence over the gastro-intestinal catarrh, but they are rarely so efficacious of themselves as the other alkaline and aperient springs named. At these spas the regular use of warm stimulating baths serves to maintain the cutaneous functions in activity; and the regular exercise in the open air, which forms part of the routine of this cure, is also most advantageous. It must, of course, be remembered that it is only in the treatment of the first stage of the disease that these mineral waters are applicable. The useful effects of alkalies in relieving the gastro-intestinal catarrh can be obtained at home, without the trouble of going to these spas.

The following dose may be ordered three or four times a day, about half an hour before taking food :—

℞ Sodii bicarbonatis	gr. xv.
Potassii bicarbonatis	gr. v.
Spiritus ammoniæ aromatici	ʒss.
Infusi aurantii compositi (*vel* aquæ menthæ piperitæ)	ad ℥jss.

Misce, fiat dosis.

This dose may be usefully diluted with an equal quantity of hot water; this will assist in dissolving and washing away stringy mucus from the mucous membrane of the stomach. If there is pyrosis and morning vomiting of catarrhal secretion from the stomach, half a dram or a dram of the liquor bismuthi et ammonii citratis may, for a time, be added to each dose of the above mixture. If there is constant nausea, a dram of aqua laurocerasi should be added to each dose; or, should there be much gastric pain and irritability, 3 to 5 minims of liquor opii sedativus may be added instead. Symptoms of an excessive amount of intestinal decomposition, such as great flatulent distension, etc., will be best relieved by a pill containing half a minim of creasote or a grain of thymol, two or three times a day. Small doses of calomel ($\frac{1}{20}$th grain) three times a day serve the same end.

We are doubtful as to the existence of any special virtue in nitro-hydrochloric acid in the treatment of these cases; it has, however, been warmly advocated by Whitla, who attributes its frequent failure to produce any good effects to its liability to decomposition, and urges that it should be always freshly prepared. He uses it locally as well as internally. For the former purpose he applies a lotion, made by mixing $\frac{1}{2}$ ounce of strong nitric acid and 1 ounce of hydrochloric acid with a gallon of warm water, on spongio-piline, to the whole of the hepatic region, until an eruption appears.

3. The treatment we have advocated for the relief of the gastro-intestinal catarrh, especially the *use of regular aperients,* will also apply to the third indication, viz. to lessen the portal engorgement. Counter-irritation to the hepatic region by linseed and mustard poultices, and the abstraction of blood by applying leeches to the anus, have their advocates, and they may be useful in the early stages of hepatic engorgement; but free and regular purgation by non-irritating aperients, such as we have already described, is the most trustworthy measure.

4. The relief of such urgent symptoms as hæmatemesis, and those that arise from a great accumulation of ascitic fluid in the peritoneal cavity, of course demands careful consideration. The management of cases of hæmatemesis has been fully considered in a former chapter (vol. i., p. 136). When it depends on portal obstruction, as in this disease, free purgation by the alkaline sulphates, given in combination with dilute sulphuric acid, should follow the other measures that have been recommended for the arrest of the bleeding.

Painful and bleeding piles are a common cause of trouble in advanced hepatic cirrhosis. In such cases the danger of operative measures makes medicinal relief imperative. The application of ice is then valuable, and preferable to the habitual astringent applications, of which ointment of galls and opium, adrenalin suppositories, and small rectal injections of hazeline and water are about the best. Ewald recommends as a suppository for internal piles :—

℞ Chrysarobini	gr. 1¼.
Iodoformi	gr. ⅓.
Extr. belladonnæ	gr. ⅙.
Olei theobromatis	gr. xxx.

M. fiat suppositorium unum.

If the piles are protruding and painful, they may be smeared with the following ointment :—

℞ Extr. belladonnæ	gr. xij.
Chrysarobini	gr. ivss.
Iodoformi	gr. ix.
Vaselini	℥ss.

Misce, fiat unguentum.

With regard to the treatment of **ascites**, authoritative opinion is now much more in favour of early and repeated *tapping* than was formerly the case.

It used to be thought that the occurrence of ascites was the almost certain precursor of a fatal termination of the disease; and it was argued that as, in the great majority of such cases, the obstruction to the portal circulation was extreme and irremediable, and that as soon as the ascitic fluid had been removed by tapping it was certain to re-accumulate, we were only, as it were, bleeding the patient into his own peritoneal cavity, and so rapidly exhausting him, and thereby hastening the fatal event.

No doubt the majority of cases of hepatic cirrhosis, when they reach the stage of the appearance of ascites, are in a bad way; but in a considerable minority of such cases recovery takes place under suitable treatment; and until the effect of the operation has been tested it is difficult to determine whether or not the case is past remedy, while, if it is past remedy, little harm can be done by paracentesis. In any case it seems to us better that the distressing pressure of the fluid accumulation, when very large, should be removed by this slight operation, than that the patient should be daily depleted by large and exhausting doses of hydragogue cathartics; and diuretics, in very large accumulations, are generally useless, owing to the pressure of the ascitic fluid on the kidneys. The cases that benefit most by tapping are those in which the effusion is mainly, if not entirely, a consequence of chronic peritonitis. Then paracentesis may be frequently repeated, and may in time be rewarded by cessation of effusion. When the effusion is mainly due to fibrosis of the liver and toxæmia, paracentesis is only of use in relieving discomfort due to pressure. Indeed, in this latter case patients are often seen to go downhill rapidly after its removal, possibly because of the drain on the body fluids resulting from its immediate replacement.

The operation of **paracentesis abdominis,** although a very simple one, should be performed with care and caution. The patient should first be given a little stimulant, then the surface of the abdomen, where the puncture is to be made, should be washed with antiseptic fluid, the bladder should be emptied, the point where the trocar is to enter should be marked—the median line, midway between the umbilicus and the pubes, is that usually selected—avoiding, of course, any dilated superficial vein; if thought necessary, the spot selected may be rendered anæsthetic by ether spray, by a piece of ice dipped in salt, or by injecting into the skin a little strong solution of cocaine; a small incision with a scalpel or lancet should first be made through the skin, and then the trocar and cannula (which should be a moderately fine one, as there is certainly no advantage in a rapid removal of the fluid) quickly introduced; these instruments should, of course, be carefully cleansed, so as to be made perfectly aseptic. Before the operation a many-tailed (three or four tails) flannel bandage should be applied to the back, and the ends held by the assistant or nurse, ready to compress the abdomen from above downwards as the fluid escapes, and when the operation is completed the ends should be firmly fastened, and the bandage arranged so that uniform pressure may be maintained over the abdominal surface. It is often convenient to attach a long indiarubber tube to the cannula, so as to conduct the fluid, as it slowly flows away, to a vessel near the patient. If the patient should feel faint during the withdrawal of the fluid, some more stimulant must be given. As much fluid should be withdrawn as possible, unless the patient shows any unfavourable symptom during its removal. After taking away the trocar, the wound in the skin should be pinched close by the finger and thumb, and some antiseptic cotton-wool and collodion applied. Cases have been recorded in which serous effusion seemed to be checked by injection of adrenalin into the peritoneal cavity after paracentesis. We have in several cases injected a dram of Parke Davis & Co.'s 1 : 1,000 adrenalin chloride, diluted with sterile water to half an ounce; in two cases we repeated the injection at intervals. We have seen no good results from the procedure, which is often attended by severe abdominal pain.

We must briefly mention the so-called *Talma-*

Morison operation for the relief of ascites, which consists in opening the abdomen and exciting adhesions between the peritoneum, omentum and liver, with the object of relieving portal congestion by development of new vascular channels in the adhesions. It is exceedingly doubtful if this is anatomically possible, and, even if it be, there is the physiological objection that the poisonous portal blood would be turned into the general circulation without purification by passing through the filter-bed of the liver. Further, there is no evidence to show that the freer supply of blood to the surface of the liver leads to functional regeneration of liver cells. The operation is not without danger, and is nearly always disappointing in its results. The few cases in which it has been attended with success are probably due to its hastening the process of obliteration of the peritoneal cavity, which was already near being effected by adhesion.

Diuretics and **purgatives,** which in many cases fail to have any effect on the dropsical accumulation before paracentesis, may often be usefully employed after the operation, to further the complete removal of ascitic fluid, and to prevent its rapid reaccumulation.

They may also be used in those cases where, for some reason or other, it is determined not to tap the patient. Besides relieving the engorgement of the portal vessels they also serve to diminish the toxæmia which is a serious element in this disease.

The purgative usually employed is sulphate of magnesia, in half-ounce doses, dissolved in as little water as possible, and given in the morning early, half an hour at least before breakfast; or compound jalap powder, in 1- or 1½-dram doses, given with a little warm water at the same hour.

Certain diuretics are undoubtedly valuable, and favour the removal of the fluid. One of the most popular and useful is the well-known pill of digitalis, squills and mercury (a grain of blue-pill and of powdered digitalis and squill in each); one of these should be given twice daily. Some prefer $\frac{1}{4}$ grain of calomel in place of the blue-pill—indeed, calomel alone has been found a very efficient diuretic in many cases. A combination of calomel and caffeine, $\frac{1}{2}$ grain of the former and 2 or 3 grains of the latter, has been found to be retained in the stomach when other drugs have been rejected, and to act well as a diuretic. Various other diuretics have been employed in these cases; a favourite combination consists of a mixture containing 30 grains of potassium acetate, $\frac{1}{2}$ dram of spirits of nitrous ether, $\frac{1}{2}$ dram of spirits of juniper, and $\frac{1}{2}$ ounce of infusion of digitalis, in each dose, which should be given thrice a day.

Resin of copaiba, in 15-grain doses, has been warmly advocated as a diuretic in hepatic ascites. It may be rubbed up with compound almond powder and water into an emulsion.

"Tincture of apocynum," in $\frac{1}{2}$-dram doses three times a day, is highly regarded by some as a diuretic.

Limiting considerably the amount of fluid taken into the stomach has, in a few instances, been found to favour the disappearance of the ascitic fluid.

Iodide of potassium and chloride of ammonium have been highly lauded by some physicians in the treatment of hepatic cirrhosis, not so much as diuretics, but for some supposed special action. Arsenic has also been credited with some power of checking the process of degeneration of the hepatic cells. We doubt if ammonium chloride has any special action on this disease. Potassium iodide, however, appears to have some influence in checking the advance of sclerosing processes: it often acts powerfully as a diuretic, and as it is sometimes impossible to say whether or not the cirrhosis, or the ascites, may have a syphilitic origin, we think it advisable to try the effect of this drug, for a time, in most intractable cases; and it is as well, in order thoroughly to eliminate the possibility of syphilis, when we are in doubt, to combine with it small doses of perchloride of mercury.

In all these cases it is highly important to combine, with our other measures, a supporting tonic treatment. The appetite may be maintained or improved by some vegetable bitter, such as gentian, or nux vomica, or strychnine, given half an hour before meals. A light, nourishing dietary should be provided, and it may be necessary, in some advanced cases, to allow a small amount of wine or spirits well diluted. For the relief of diarrhœa, severe vomiting, and insomnia—symptoms which occasionally assume considerable prominence—formulæ will be found at the end of this chapter.

5. When **toxic** symptoms appear the disease is usually advanced, and little can be hoped from treatment. In the absence of diarrhœa, the effect of brisk purging may be tried, and the action of the skin should be promoted by hot-air baths as in uræmic cases. Transfusion of saline solution sometimes puts off the evil day ; if there is diacetic acid in the urine, two drams of bicarbonate of soda may be added to each pint of saline solution.

6. The maintenance of the strength of the patient, by supporting and tonic treatment, has already been insisted upon.

A few words remain to be said as to the treatment of certain varieties of hepatic cirrhosis.

In *biliary cirrhosis,* where there is obstruction of the bile-ducts and marked jaundice, and usually no ascites, the indications for treatment do not differ greatly from those of the typical form. It is even less amenable to any but palliative measures. The bowels should be regulated by the aperient sulphates, such as Carlsbad and Marienbad salts ; warm alkaline drinks, such as Vichy or Apollinaris water, should be given half an hour or an hour before food, and the diet should be light and simple. In a few instances brilliant results have followed on drainage of the gall-bladder, possibly by relieving an infective cholangitis. We may, therefore, consider the desirability of early surgical intervention.

Syphilitic cirrhosis, which may be met with in children and young adults from inherited syphilis, and which is occasionally associated with gummata in the transverse fissure compressing the portal vein, or the hepatic ducts, so as to give rise to jaundice or ascites, requires the administration of potassium iodide and mercury, as we have already pointed out.*

In so-called *malarial cirrhosis* the liver is usually enlarged, and the symptoms are somewhat indefinite, but jaundice is usually present. A course of Carlsbad or Vichy waters, or regular use of the alkaline and saline aperient salts derived from those springs, with an occasional mercurial or other cholagogue purge, should be prescribed. The use and application, as already described, of nitro-hydrochloric acid, is especially applicable to these cases. Arsenious acid ($\frac{1}{50}$th grain) in a pilule after each meal, continued for some time, is also of great use in attacking the malarial element.

In conclusion, we must remark that hepatic cirrhosis is a *remediable*, but not a *curable*, disease. As Osler well observes: "So far as we have any knowledge, no remedies at our disposal can alter or remove the cicatricial connective tissue which constitutes the *materia peccans* in ordinary cirrhosis. On the other hand, we know that extreme grades of contraction of the liver may persist for years without symptoms when the compensatory circulation exists. The so-called cure of cirrhosis means the re-establishment of this compensation."†

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* Bristowe reported a remarkable instance of this form of ascites, in which all treatment failed until the syphilitic nature of the case was accidentally discovered (*British Medical Journal*, April 23rd, 1892).

† "Practice of Medicine" (4th edition), p. 576.

ADDITIONAL FORMULÆ

Purgative pills in hepatic cirrhosis

℞ Pulveris radicis rhei, ʒij.
Extracti aloes, gr. xxx.
Extracti colocynthidis, gr. vj.
Extracti rhei, q.s.

Ut f. pil. lx. Two to be taken twice a day. (*Bamberger.*)

Pills in hepatic cirrhosis

℞ Podophyllin, gr. vj.
Capsici, gr. iv.
Pulveris rhei, gr. xxij.

M. et div. in pil. xij. One on alternate nights. (*Da Costa.*)

In early stage of hepatic cirrhosis

℞ Sodii bicarbonatis, ℥ss.
Infusi gentianæ, ℥vj.

M. f. mist. A tablespoonful three times a day, between meals. (*Da Costa.*)

Pills in chronic hepatitis

℞ Extracti taraxaci. gr. xxxvj.
Extracti aloes, gr. xij.
Extracti colchici acetici, gr. vj.
Pulveris ipecacuanhæ, gr. vj.

M. et div. in pil. xij. Two every night. (*Martin.*)

In hepatic congestion

℞ Ammonii chloridi puri, ℥ss.
Aquæ menthæ piperitæ, ℥iij.

M. f. mist. A dessertspoonful three times a day. (*Murchison.*)

Mixture in hepatic cirrhosis

℞ Acidi nitro-hydrochlorici diluti, ℥ss.
Extracti taraxaci liquidi, ℥ij.
Tincturæ nucis vomicæ, ʒiij.
Extracti cinchonæ liquidi, ʒiijss.
Infusi chiratæ ad ℥xij.

M. f. mist. A tablespoonful in a wineglassful of water to be taken four times a day before food. (*Whitla.*)

Diuretic pill and mixture

℞ Pulveris scillæ, gr. jss.
Pulveris digitalis, gr. ss.
Pilulæ hydrargyri, gr. ij.

M. f. pil. To be taken two or three times a day.

℞ Potassii acetatis, gr. xx.
Spiritus ætheris nitrosi, ʒss.
Decocti scoparii ad ℥jss.

M. f. haust. To be given with each dose of the above pills. (*Murchison.*)

For severe diarrhœa

℞ Bismuthi carbonatis, gr. xv.
Magnesii carbonatis, gr. x.
Tincturæ cinnamomi, ʒss.
Mucilaginis, ʒj.
Aquæ ad ℥j.

M. f. haustus. To be taken occasionally when the diarrhœa is urgent.

For severe vomiting

℞ Spiritus ammoniæ aromatici, ♏xv.
Aquæ laurocerasi, ʒi.
Spiritus chloroformi, ♏xv.
Aquæ ad ℥j.

M. f. haustus. To be taken occasionally to allay vomiting.

For insomnia

℞ Chloral hydratis, gr. x.
Sodii bromidi, gr. xv.
Tincturæ lupuli, ʒss.
Aquæ chloroformi, ℥j.

M. f. haustus. To be taken at bed-time.

To check hepatic degeneration

℞ Liquoris arsenicalis, ♏iij.
Ferri tartarati, gr. v.
Potassii bicarbonatis, gr. x.
Aquæ chloroformi ad ℥j.

M. f. haustus. To be taken three times a day. (*Bruce.*)

CHAPTER IV

TREATMENT OF HYDATID CYSTS OF THE LIVER

Origin, Nature, and Development of Hydatid Cysts—The *Tænia echinococcus*—Prophylactic Measures—Characters of Hydatid Fluid—Symptoms often Absent, sometimes Obscure—Possible Results—Spontaneous Cure—Suppuration with Pyæmia—Rupture. *Treatment*—(1) by Internal Medication—Potassium Iodide, etc. (2) Simple or Electro-puncture—Urticarial Rashes after Puncture. (3) Tapping with Aspiration—Different Opinions as to its Safety—Aspiration with Hypodermic Syringe. (4) Injection of Medicinal Substances. (5) Abdominal Section, Free Incision and Drainage—Advantages of this Method.

A **globular painless tumour** in the hepatic region is generally a hydatid cyst. A hydatid cyst is not, strictly speaking, a *disease of the liver*, as it may and does occur in other organs, but clinically its consideration is not unnaturally associated with that of enlargements of this organ, and its treatment may therefore be now conveniently considered. A hydatid cyst in this situation may attain a great size without giving rise to any complaint, and it has not unfrequently happened that the presence of such a cyst has only been discovered when some accidental circumstance has led to its rupture.

In order to consider the subject from the point of view of prophylaxis, as well as of cure, it will be needful to refer briefly to the origin and nature of these remarkable cysts.

A hydatid cyst represents a phase in the singular life-history of a very small tapeworm, the **tænia echinococcus,** found in the intestine of the dog. This tapeworm, when fully grown, only measures $\frac{1}{6}$th of an inch in length, and consists of but three or four segments, the last segment containing the sexual organs, and in this the vastly numerous ova are developed and pass out of the dog's intestine with the fæces; they are thus liable to get into any open watercourse, or to be deposited on the leaves or stalks of fresh vegetables. Should this ovum reach the human stomach its shell is dissolved by the gastric juice, and the liberated embryo, by means of six small hooks with which it is provided, bores its way through the walls of the stomach or intestine and most commonly gets conveyed to the liver, probably by penetrating into one of the tributaries of the portal vein and being carried onwards by the portal blood-stream until it is arrested in one of the portal capillaries; hence it finds its way into the hepatic tissue. Here the hooklets disappear, and the embryo is gradually converted into a small cyst. It grows larger and becomes converted into a vesicle containing a transparent fluid. Besides its own proper capsule, it becomes enclosed (probably by irritation of surrounding tissue) with a distinct investing membrane of vascular connective tissue. This outer capsule grows with the hydatid. The subsequent development of the hydatid is of some practical importance. From the interior of the parent or "mother cyst," usually a number of buds or smaller cysts develop; these, at first attached by a pedicle, are afterwards set free and are termed "daughter cysts," and within them "granddaughter cysts" may develop in the same manner; so that the parent cyst may become filled with a vast number of smaller cysts of various sizes. Subsequently the interior of the parent cyst develops buds, which, instead of forming detached vesicles, remain connected with it and form *scolices* or *heads*, provided with suckers and hooklets, and these, if they reach the intestine of a suitable host, are capable of growing into tæniæ.

So far, then, as prophylaxis in the human subject is concerned, the chief measure is to avoid all drinking-water or food substances that can by any possibility have become contaminated with the excrement of dogs. This is especially important in countries such as Iceland and in some parts of Australia, where the parasite is known to abound in the intestines of these animals. In some countries it is extremely rare, as in America; it is said to be common in London dogs (*Fagge*), but as there are practically no open water-courses in London from which drinking-water is derived, it must be from allowing dogs to live in the same apartments, and in great intimacy, with human beings that the latter become affected, doubtless by the pollution of some articles of food.

In Iceland, owing to the great number of dogs there (equal to nearly one-third of the population), and the domestic intimacy permitted them, this disease is so common that it has been estimated to be present in from a tenth to a thirteenth of the entire population. In Australia, also, where dogs are employed in great numbers for herding sheep, this malady is common. The sheep are the hosts of the larval form, and as their intestines, after slaughter, are commonly given to the dogs to eat, the circle of infection is maintained.

The temptation to drink, in such countries, from a running stream or from a spring that is open to possible contamination, should be resisted, and the risks attendant thereon should be pointed out to peasants, soldiers, workmen, travellers, and others who are especially exposed to this temptation. Boiling, or filtering through a charcoal filter, will render such water safe.

The fluid of a hydatid cyst is clear and limpid, of a specific gravity of 1,005 to 1,009. It does not contain albumen, and is not rendered cloudy by heat or nitric acid. It contains traces of sodium carbonate and chloride, and, it is said, occasionally of sugar. When this fluid is withdrawn by puncture, scolices or echinococci can often be found floating in it or deposited from it, or hooklets may be found in the deposit, either being diagnostic of the nature of the fluid.

Symptoms, as we have already said, are sometimes entirely absent, even in the case of large cysts—

this, of course, depends on their situation. Sometimes the cyst forms a distinct globular tumour in the epigastric region, or it may protrude the ribs and intercostal spaces in the right hypochondrium, or appear below the costal arch; or it may project from the upper surface of the right lobe of the liver and encroach on the pleura and lung, and give rise to a peculiar arched area of dulness in the lower and back part of the chest on the right side; or it may be more deeply seated, and then it may give rise to symptoms of some obscurity. If the cyst is superficial it can usually be recognised by its smooth, rounded form, its tense, firm feel, and sometimes by fluctuation. The so-called *hydatid fremitus* is often absent, and must not be regarded as of much significance. Some weight and dragging, and sometimes pain in the hepatic region, are associated with large cysts.

The presence of other symptoms may be determined by the *result* of the disease: (1) The hydatid may die; the cyst then diminishes in size, the capsule thickens, shrinks, and becomes calcified, and the contents dry up into a putty-like mass and there is *spontaneous cure.* (2) The cyst may *suppurate,* and pyæmic symptoms may appear, rigors, sweatings, emaciation, and more or less jaundice, and the surface of the tumour may become hot, tender, painful, and red, and it may sometimes be difficult to distinguish it from a hepatic abscess. (3) The cyst may *rupture,* before or after suppurating, into any of the surrounding parts, or externally; rupture into the peritoneum is usually quickly fatal; into the pericardium or into the vena cava is immediately fatal; into the bile-ducts causes intense jaundice, and is almost invariably fatal; into the stomach, colon, pleura, or bronchi may be attended by recovery; the last event is the most favourable.

The **treatment** suitable to hydatid cysts of the liver must depend somewhat on their size, their situation, and the presence or absence of signs of suppuration of the cyst. Small cysts, not exceeding a small orange in size, not showing any tendency to increase, and not giving rise to any pain or inconvenience, may be left alone with a fair prospect of their undergoing spontaneous cure; for it must be borne in mind that dangerous symptoms have been occasionally observed to follow every kind of operation for the cure of hydatid cysts of the abdomen.

It will be instructive to consider the several measures that have been successively advocated for the treatment of hydatid cysts of the liver. They are the following:—

1. Internal medication. 2. Simple or electro-puncture. 3. Tapping, with or without aspiration. 4. Injection of medicinal substances into the cyst. 5. Abdominal section, free incision, drainage and irrigation.

1. *Internal medication* is now generally discredited. Kamala, sodium chloride, and potassium iodide have been advocated; the last-named drug has been spoken of favourably by Professor Jaccoud and by Semmola. Semmola maintained that he had demonstrated the presence of iodine in the fluid of the hydatid cyst, in certain cases, after the exhibition of potassium iodide. After a few days of treatment with the iodide he withdrew some of the liquid by aspiration, and if he found iodine in it he continued the treatment, and obtained a reduction in the size of the tumour and its conversion into a solid mass; if, on the contrary, he failed to find iodine in the fluid aspirated, he adopted another method of treatment. An obvious source of fallacy here is that simple puncture and withdrawal of even a small quantity of fluid will suffice, of itself, to effect a cure in many cases.

2. *Simple puncture*, or puncture with *electrolysis*, was found by Fagge to be a most effectual means of curing some forms of hydatid tumour. He believed that the application of the galvanic current was not an essential part of the process, but

that the simple insertion into the cysts of one or two slender gilt needles (with antiseptic precautions, of course), which were left there for ten minutes and then carefully withdrawn, sufficed for the cure.

This treatment is only applicable to hydatids of moderate size and that are quite superficial. Fagge believed that in these cases the death of the parasite was due to an escape of some of the hydatid fluid into the peritoneal cavity, and this belief was founded on the observation that in some instances fluctuation could be detected in the lower part of the abdominal cavity a few hours after electrolysis, and that an *urticarial rash* appeared a day or two afterwards. Such a symptom has often been observed to follow the absorption of hydatid fluid, and is believed to be caused by some toxic substance generated in it after its death.

3. *Tapping*, together with *aspiration*, is a measure that has been employed for hydatid cysts of moderate size and superficially situated.

If a fine capillary trocar and cannula be used, if antiseptic precautions be carefully observed, if great care and caution be taken in their introduction and removal, and if the aspirating suction be not too strong, the risk of the procedure is comparatively slight. Some difference of opinion, however, exists amongst authorities as to the safety and suitability of this practice. Fagge thinks aspiration inapplicable, and possibly injurious, if the cyst is enclosed in the liver. "To exert forcible suction," he says, "by an aspirator upon a cyst surrounded by solid tissue must involve some risk." But there seems to be no reason whatever for using "*forcible* suction"; a slight suction-force should be sufficient to withdraw a *portion* of the fluid, and that, according to Fagge, is all that is necessary "to ensure the ultimate disappearance of the tumour." Dujardin-Beaumetz, however, urged as an important precaution, "that all the fluid should be withdrawn from the cyst," and that the "aspiration should be as complete as possible."* As against withdrawal of only a *portion* of the fluid, it may be urged that there is the danger of the residual fluid leaking into the peritoneum. Further, there is the likelihood of the production of abundant toxalbumins in the fluid on death of the cyst, and these have occasionally produced grave and even fatal toxic symptoms.

If we are disposed to trust to the withdrawal of a *small portion* of the fluid in order to effect a cure, a very useful instrument for the purpose is a syringe, made precisely like a hypodermic syringe, only much larger, to hold at least an ounce of fluid, and it should be furnished with a needle about twice as stout and three or four times as long as the hypodermic needle. This is a very handy instrument for exploratory punctures, and in a small or moderate-sized hydatid cyst, two punctures (which would give no more pain than the two needle punctures advised by Fagge) cautiously made, and the withdrawal of two ounces of fluid, if it did not suffice to kill the parasite, as it might do, would at any rate inform us as to the nature of the fluid, and if by chance the cyst had suppurated we should know that it was necessary to resort immediately to other measures. So that we should prefer aspiration of this modified kind to acupuncture.

After tapping or aspiration the cyst sometimes, within a few weeks, increases in size, and if it be again tapped, the fluid removed will be found to be cloudy and to contain albumen. This is probably due to the death of the echinococci, and their solution: "they abandon to the fluid the albuminous matter of which they are formed."

At any rate, this increase in size of the cyst should not lead us to conclude that a repetition of the aspiration is needed. It is rather an indication of changes associated with the death of the parasite, and in course of time the tumour will again diminish in size and finally disappear. Fagge laid it down as a rule that no second operation on a hydatid cyst should be performed within twelve months, unless there was some reason to think suppuration had taken place.

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* This author also insisted that a capillary trocar and cannula, the piercing-point of which can be withdrawn, is much safer than a pointed needle, which may wound the wall of the cyst, and cause hæmorrhage.

4. The injection of medicinal substances into the cyst, such as iodine, ox-gall, male-fern, etc., after removal of a little fluid, is not usually a commendable expedient. Bacceli recommended a method of treating hydatid cysts by injecting into the cyst (after the withdrawal of 20 cubic centimetres of the fluid) 20 grammes of a solution of corrosive sublimate, 1 : 1,000. This method has, however, not infrequently led to suppuration of the contents of the cyst, and more than once to mercurial poisoning.

5. Finally, we come to the method which is now most generally approved of in dealing with all the more serious forms of this disease, viz. **abdominal section, free incision, and evacuation** of the cyst by drainage and irrigation. This is the only method suitable to the treatment of suppurating cysts, and it is the best also in the case of all cysts of large size. By incision into the abdominal cavity the surgeon is able to see what he is dealing with, and to ascertain the position and relation of the tumour. The risks of haemorrhage and of escape of bile, owing to communication with a large biliary channel, are reduced to a minimum, and the whole contents of the cyst can be completely evacuated. It has been truly said that when a needle is plunged into the region where a hydatid cyst is situated, it is like "striking in the dark." The surgeon is also able to discover whether adhesions do or do not exist, and if they do not exist, by stitching the wall of the cyst to the parietal peritoneum and to the abdominal wall he is able to open the cyst freely without fear of the escape of any of its contents into the abdominal cavity; and further, by making a free opening in the cyst, he is able to explore it with his finger, and to promote its complete and aseptic evacuation.

PART VI.—URINARY AND RENAL AFFECTIONS

CHAPTER I

TREATMENT OF MORBID STATES OF THE URINE

Variations in Characters of Urine consistent with Health.

LITHIASIS.—Deposit of *Amorphous Urates*; its significance—Deposit of *Uric Acid*; its causation—*Treatment* of Uric Acid Deposits; *Preventive and Remedial*—Food and Food Habits—Alkalies—Water-drinking—Utility of Mineral Springs—Aperients—Exercise, Baths, and Frictions.

OXALURIA.—Mode of Origin of *Oxalates* in Urine—Relation to Dyspeptic States and to the Formation of Calculi—*Indications for Treatment*—Dietetic, Hygienic, Medicinal.

PHOSPHATURIA.—Deposit of *Amorphous Phosphate of Lime*; its significance—Phosphatic Diabetes—Treatment of habitually Alkaline Urine—Deposit of *Triple Phosphate* in Decomposing Urines—Relation to Vesical Calculus—Causation—*Bacterial Agency*—Relation to *Cystitis*—*Indications for Treatment*.

HÆMATURIA.—Etiology—Sometimes Endemic and Parasitic—Seat of Hæmorrhage—*Treatment*—Rest, Bland Drinks, Astringents—Ergot—Local Remedies—Injections into the Bladder—Gelatine.

HÆMOGLOBINURIA.—Characters of the Urine—Different Forms—*Paroxysmal* Form—Causation—*Treatment*—Protection from Chill—Drugs—*Toxic* Form.

CHYLURIA.—Origin—Prophylaxis—Treatment.

ALBUMINURIA.—As a Symptom of various Diseases—In "apparently Healthy" Persons—Conditions under which it occurs—*Treatment*. Additional Formulæ.

WE shall consider the subject of the **treatment** of urinary and renal affections under two principal divisions: (1) the treatment of morbid states of the urine, together with that of renal calculi; and (2) the treatment of congestive and inflammatory diseases of the kidneys. We shall, however, reserve the consideration of the treatment of diabetes until we deal with the subject of constitutional diseases.

Many morbid states of the urine cannot be regarded as, in any sense, *local* diseases, but rather as expressions of constitutional morbid conditions, and so entirely is this the case with regard to one common pathological state of the urinary secretion, viz. *glycosuria*, that, as we have already said, we do not propose to consider it in this Part. Yet in many of these the symptoms complained of, as well as certain of the pathological changes induced, are manifestly local, and we are only following a universally accepted classification in considering them as amongst urinary and renal diseases.

It should be borne in mind, in considering whether any particular specimen of urine is morbid or not, that, in different individuals, very great differences may be encountered in the amount of *water* secreted in the urine, so that its specific gravity may vary within very wide limits, from 1005 to 1030, consistently with health ; and with this great variability in the amount of water secreted in the urine there will be corresponding variations in the colour and in the capability of retaining in solution the urinary solids. A urine of high specific gravity (unless this depends on the presence of sugar) will be of darker colour, and more likely to deposit urates on cooling, than a urine of lower density. Persons who perspire freely and lose much water by the skin, especially if they are in the habit of drinking sparingly of water, will often pass urine very dark in colour and of high specific gravity, and we should inquire into these habits before concluding that the urine is morbid. Those, on the other hand, who perspire but little and drink freely of water or aërated waters, or of diuretic beverages, such as tea and coffee, will usually habitually pass an abundant quantity of pale urine of low specific gravity.

In examining proposers for life insurance, particularly those of high-strung nervous temperament, it is quite usual to meet with urines of specific gravity but little above 1,000.

LITHIASIS; THE DEPOSITION OF URIC (OR LITHIC) ACID AND URATES IN THE URINE

The deposition of *amorphous* **urates** is one of the commonest of occurrences in urine after it has been voided and on cooling. Its occasional occurrence is not inconsistent with perfect health, and may be determined simply by an unusually low temperature, or by active or severe exercise, or by excessive perspiration. It also frequently occurs in association with a variety of morbid states—some trivial, some grave, as in common colds or chills, in some dyspeptic conditions, in fevers, and in most wasting diseases. In fevers this deposition may be in part due to the excessive loss of water by the skin and lungs, owing to the high temperature and the quickened circulation.

The urine must always be *acid* for this deposition to take place. It only appears as the urine cools, and it again disappears on warming the urine. It is usually more or less deeply coloured by urinary pigment, but pale, almost colourless, urates are occasionally met with.

The amorphous urates, as found in human urine, are, as Sir William Roberts's investigations have shown, *quadri-urates*. This is the special physiological combination of uric acid. When uric acid departs from this normal state of combination it is apt to give rise to morbid phenomena. *Free uric acid* is only met with in the human body as a *morbid* product, as a crystalline deposit in the urine, and as gravel and calculus in the urinary passages. *Bi-urates* are also pathological products; they occur as so-called "gouty" concretions in the tissues, and their history will be considered in treating of gout.

These quadri-urates are very unstable. "In weak solutions of the alkaline carbonates or of the di-metallic phosphates they slowly take up an additional atom of base and are converted into bi-urates. On the other hand, in water, and in watery solutions of the neutral salts, they are split up into free uric acid and bi-urate."* Uric acid is extremely insoluble,† and when, in certain circumstances, the quadri-urates (of potash, soda, and ammonia) in human urine become decomposed in the urinary passages and uric acid is set free, it is deposited in the crystalline form, and thus may give rise to the symptoms of gravel. This tendency may not in other cases be shown until after the urine is voided, when a copious deposit of characteristic crystals of uric acid takes place.‡

It may be of some importance to note that "all acid urines, if guarded against septic changes, deposit uric acid sooner or later," and if it were not for the presence of some inhibitory ingredients, which greatly retard the water of the urine from breaking up the quadri-urates, "uric acid would be thrown out daily in the urinary passages, and everyone would be subject to gravel." It would appear that the salts and the pigments are the chief of these inhibitory ingredients.

The preceding observations may assist us in elucidating the **etiology** of **uric-acid** gravel.

An undue poverty of the food in *saline* constituents may predispose to the precipitation of uric acid in the urinary passages. The comparative frequency of stone amongst the children of the poorer classes may thus be traced to their food, consisting chiefly of substances poor in mineral salts—as is the case with farinaceous substances—bread, oatmeal, and potatoes; whereas milk, meat, and fish, which enter so much more largely into the dietary of the children of the well-to-do, contain a far greater proportion of mineral salts. Stone is also very common in India, where rice—a food very poor in mineral constituents—forms the chief part of the diet of the natives, and then the urine must also necessarily be poor in saline substances. The freedom from gravel and stone which sailors are known to enjoy has been referred to the great quantity of salt they consume with their food. The tendency to precipitation of uric acid in chronic Bright's disease may be referred to the almost entire absence of pigment in the pale urine of low density passed in this disease.

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* Sir W. Roberts, "Uric Acid, Gravel, and Gout," p. 30.

† A gramme requires for its solution at ordinary temperatures 14 litres of water, and about half that amount at the temperature of the body.

‡ These crystals look like grains of cayenne pepper; they are usually in the form of rhombs or prisms of a deep red colour, owing to staining with urinary pigments.

In another class of cases in which uric acid deposits are common, *i.e.* in the over-fed, rich, and indolent, the urine abounds in salts and in colouring matter, and another cause must be sought to explain this tendency; no doubt in these cases the precipitation is due to the excessive acidity of the urine and to the excessive quantity of uric acid in it. It has been experimentally established that the higher the percentage of uric acid in urine (out of the body) the more rapidly is the uric acid precipitated, and it has also been shown that the addition of a very minute quantity of an alkaline carbonate to normally acid urine postpones considerably the deposit of uric acid.

Sir William Roberts's experiments justify the conclusion that "high acidity, poverty in salines, low pigmentation, and high percentage of uric acid" tend to accelerate the precipitation of uric acid, and that "depressed acidity, richness in salines, richness in pigments, and low percentage of uric acid" tend to retard precipitation. The most important of these factors appears to be the degree of acidity.

The **treatment** of uric acid deposits may be either preventive or curative. Much may be done by medicinal and hygienic treatment to limit the tendency to the deposition of uric acid in the urinary passages. But it is important not to associate too intimately the occurrence of uratic deposits in the urine with gout, as is sometimes done.

Sir William Roberts has well pointed out that although the two tendencies are often found together, they are also often found separately, and that while in gout the precipitation is believed to take place in the blood and tissues, and the uric acid is deposited in the form of a chemical combination—sodium bi-urate,—in gravel the precipitation takes place, strictly speaking, outside the economy, in an excretion—the urine,—while it is certainly still *in contact* with the urinary passages, and the uric acid is deposited in the *free*, not in a combined, state.

These tendencies own, undoubtedly, a close relationship, but they are not exactly identical; it is, however, quite possible that the same constitutional vice, modified by some other controlling influence which we do not understand, in the individual, determines in one a precipitation of free uric acid in the urine, and in another a deposit of sodium bi-urate in the tissues. It is remarkable that in districts where calculous disorders are common, gout is of rare occurrence; and conversely, where gout is common, calculous disorders may be infrequent.

These considerations are important from the point of view of therapeutics, as, in the case of uric acid gravel, it is to modifying the urinary excretion that our attention should, in a special manner, be directed.

As it has been shown that a deficiency of saline matters in the urine favours the tendency to deposition of uric acid, we should endeavour to supply this deficiency by suitably modifying the food of persons with this tendency. The free admixture of common salt with the food is one means of accomplishing this, and when the habitual food is found to be composed of substances poor in salines—as rice, potatoes, and farinaceous foods generally—we should endeavour to replace them by others rich in salts—as animal flesh, fish, eggs, milk, and fresh vegetables.

Although in certain circumstances and in certain cases precipitation of uric acid may occur in urine which contains *less* than the normal average of this ingredient, such an accident is of rare occurrence, and we may assume, as a basis for our therapeutic injunctions, that an excessive amount and a high percentage of uric acid in the urine, when other favouring conditions co-exist, greatly increase the tendency to the production of gravel. When such a condition of the urinary excretion exists some attempts should be made, by modification of the diet, to alter it.

It has been experimentally established that a reduction in the amount of albuminoids in the foodis attended by a diminution in the excretion of uric acid, and that an increase in the amount of albuminoids consumed is followed by an increase in the excretion of uric acid.* We should carefully inquire into the food habits of patients who suffer from uratic deposits, and we should limit the intake of animal albuminoids, such as butcher's-meat, game, the firmer and richer kinds of fish, eggs, cheese, etc., to the quantity actually necessary for the due nutrition of the body ; as a fact, very many men, especially of the easy classes, consume an amount of animal albuminates largely in excess of the nutritive wants of the system, and this doubtless is one reason why they suffer so much more from this affection than temperate men of the labouring classes. Such persons should be urged to reduce the quantity of animal food which enters into their daily dietary, and replace it by consuming a larger proportion of farinaceous foods, of fresh vegetables and salads, and of fruit.

An **excessive acidity** of the urine is undoubtedly one of the most potent factors in causing the precipitation of uric acid, and our first and chief therapeutic effort should be to moderate or remove this excess. There is no more important fact to be borne in mind, in connection with this matter, than that *uric acid cannot be deposited from an alkaline urine*, and it cannot be deposited *prematurely* (*i.e. within* the urinary passages) even in urine that is neutral or feebly acid. In our endeavours to prevent this excess of acidity in the urine it may help us to remember certain facts that have been established with regard to this excretion. The taking of food lowers its acidity and augments its quantity; fasting has the opposite effect. It follows naturally that sleep has the same effect as fasting, and that it is followed by an increase in the acidity and a relative diminution in the amount of urine. It is therefore during sleep, and especially in the early morning, for an hour or two before breakfast, that there is the greatest risk of precipitation of uric acid in the urinary passages. During sleep many factors favour the deposition of uric acid; the urine secreted is relatively excessively acid, it is scanty, it is rich in urates, and owing to the complete repose of the body the renal stream is comparatively slow and stagnant. During the day opposite conditions prevail. Our protective measures then should be especially applied at bed-time, and in more intractable cases in the early morning also—or during the night if the patient is restless. These remedial indications are (1) to lessen the acidity of the urine and (2) to increase its dilution. In order to lessen the acidity of the urine, alkalies must be given. For this purpose we prefer a mixture of 15 grains each of sodium and potassium bicarbonate, together with 5 grains of sodium chloride, dissolved in a breakfast-cupful of warm milk and water, about one-third milk and two-thirds water. This dose may be taken at bed-time and on waking in the morning, and during the night if restless and wakeful. In slight cases, and merely as a preventive, one such dose daily will suffice; in more decided cases two, or even three, should be given. Some use potassium citrate in doses of 40 to 60 grains dissolved in 3 or 4 ounces of water. We think the bicarbonates more effective, as they also relieve excessive gastric acidity, which is often present in these cases.

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* In health the daily amount of uric acid excreted depends much on the diet. With a vegetable diet, half a gramme may be excreted ; with an animal diet, as much as two grammes.

It is, however, better to use the citrate if we give the dose *soon after* food, as we do not then desire to neutralise the acid gastric juice.

The advantage of milk and water as a vehicle, together with the addition of a few grains of chloride of sodium, is that it makes the mixture quite a pleasant drink, taking away the alkaline taste, and that it is an efficient diuretic, and therefore promotes another most important indication, viz. the free dilution of the urine. We have found a few grains of sodium bicarbonate, when dissolved in a cupful of hot milk and water, rapidly produce a considerable diuretic effect with many persons. In very intractable cases a drink of this kind should also be ordered to be taken about an hour before lunch and dinner, in addition to the above night and morning alkaline draughts. The reaction of the urine should be frequently tested, and the alkaline doses should be diminished as soon as it is found safe to do so.*

Persons predisposed to uric-acid gravel should not allow too long intervals to occur between their meals. The usual effect of a meal is to render the urine for a time alkaline, and to dilute it in proportion to the quantity of water consumed; *after* assimilation the urine again becomes acid and more concentrated. At the same time it must be remembered that it would be a serious error to urge such persons, when they suffer also from languid and slow digestion, to take another meal before the preceding one has been digested; that might simply have the effect of producing an acid dyspepsia, which would greatly aggravate the tendency to uratic deposits. If a light breakfast is taken at 8.30 a.m., the mid-day meal should follow at 1.30, and the evening meal not later than 7.30, while at 12 noon, at 5 p.m., and at bed-time, a tumblerful of milk (one-third) and potash or Vichy water (two-thirds) should be drunk.† This plan we consider far preferable to *frequent* feeding.

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* A specimen of freshly-voided urine should be set aside in a test-tube, kept warm to prevent the deposition of amorphous urates, and if precipitation is morbidly imminent crystals of uric acid will soon appear; if they do not appear for several hours precipitation is not morbidly imminent, and the antacid medication may be moderated or discontinued (Sir W. Roberts, Croonian Lectures).

† Ten grains of potassium bicarbonate in a tumblerful of milk (one-third) and water (two-thirds) will do quite as well.

The object of alkaline treatment is not necessarily to render the urine alkaline, but to diminish its acidity sufficiently for the precipitation of uric acid not to occur within the urinary passages, where it becomes a source of danger, but to be postponed until after the urine has been voided, when no harm can follow its deposit.

Substitution of vegetables and fruit for part of the animal moiety of the food will induce a corresponding diminution in the acidity of the urine. Meat increases the excretion of acid sodium phosphate, while the vegetable acids appear in the urine in the form of carbonates.

Another useful preventive of uric acid precipitation is the habitual consumption of an adequate quantity of pure **water** or of beverages which substantially have the same diluting effect on the urine. Sir William Roberts has pointed out that this may occasionally be "a two-edged weapon," and by diminishing the degree of pigmentation and the proportion of salines in the urine it may certainly favour the deposition of uric acid. But we believe, and, indeed, Sir William Roberts admits, that such contingencies must be excessively rare; and we may conclude that, as a practical rule, the free consumption of pure water is altogether an advantage to persons subject to uratic deposits. It must not be trusted to alone, but, combined with the other means we have referred to, it is a valuable auxiliary.

Alkaline mineral springs, such as Vichy, which justly heads the list, Vals, Ems, Royat, Neuenahr, and Apollinaris, are of great value in the treatment of uric-acid gravel; they both dilute the urine and diminish its acidity, and, moreover, when drunk as they are at their sources in considerable quantity, they flush the urinary tracts and carry away concretions that may be already lodged there.

Of late years it has been the fashion to advocate the use of non-alkaline mineral waters in the treatment of uric-acid gravel, and altogether fanciful dangers attending the use of the alkaline springs* have been invoked or invented to enhance the reputation of those spas which have not the advantage of possessing such springs. Springs very feebly mineralised, such as *Evian*, or containing chiefly a little calcic sulphate, as those of *Contrexéville* and *Vittel*, in France, have been especially advocated. Undoubtedly uric acid concretions, even of considerable size, have been frequently found to be evacuated during and after a course of Contrexéville waters. In this resort *very large quantities* of the mineral springs are frequently prescribed, and we can scarcely doubt that it is mainly to the mechanical flushing of the urinary passages by these large quantities of water that the remedial effects are due.

But, to quote again Sir William Roberts, "A preventive treatment should be available all the year ronnd, and be capable of timely application whenever the emergency arises. I see no reason . . . . why sufferers from this kind of gravel should not, by a prompt resort to antacid remedies, be able at all times to protect themselves effectually against fresh formation of uric acid concretions, and thereby save themselves from a world of pain and danger."†

A regular, free, daily evacuation of the bowels is most important in these cases, for, by promoting hepatic and intestinal excretion, we lessen the risks of excessive elimination of acid urates in the urine. A mild aloetic pill at night, combined occasionally with half a grain of calomel and followed by a tumblerful of Carlsbad water in the morning, will be found most useful.

Regular, adequate exercise in the open air is advantageous, and should be recommended in most cases, with a view to promoting complete oxidation of nitrogenous waste into the soluble area. We are not, however, in favour of prescribing very active physical exercise in *all* cases indiscriminately, as we may, by so doing, cause in some persons an increase in the excretion of acid urates from excessive nitrogenous metabolism, and in persons who perspire freely we may also produce a dangerous concentration of the urinary excretion in the urinary passages.

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* Dujardin-Beaumetz, referring to this, observed that it was Trousseau who invented the "alkaline cachexia," and remarked that since that epoch the experimental method had shown that the alkalies promote and regulate nutrition rather than enfeeble the organism ("Clinique Thérapeutique," vol. ii., p. 226).

† Croonian Lectures, 1892, p. 70.

The excretory functions of the skin should be promoted by regular baths and by friction of the surface.

If dyspeptic symptoms co-exist, these must be dealt with in accordance with the principles already laid down in another chapter; more especially a great simplicity and moderation in the diet must be enforced. Alcoholic stimulants should be, if possible, entirely abandoned, or limited to a small quantity of hock or other similar light wine mixed with an alkaline water.

The utility of certain of the recently introduced so-called "solvents" of uric acid we shall refer to in the next chapter, when dealing with the subject of the treatment of renal calculi.

Oxaluria

This term is applied to the continued or frequent presence in the urine of crystals of **oxalate of lime.** Their usual form—that of small, colourless, octahedral crystals—is well known and characteristic; as is also their occasional appearance in what has been termed the "dumb-bell" form. It has been estimated that in health about a grain and a half of oxalate of lime is passed daily in the urine.

The mode of origin of the oxalates has not been clearly ascertained. It has been maintained by some that they are wholly due to oxalic acid introduced into the stomach in vegetable substances. The oxalates have been regarded by some French authors as the gravel of ill-nourished persons—the peasants and the poor who live almost entirely on vegetable food.

They do not admit the existence of the so-called "oxalic diathesis," but look upon the appearance of oxalate of lime in the urine as altogether accidental. Esbach's researches show that a vast number of common articles of food contain oxalic acid. Sorrel, spinach, rhubarb are especially rich in it. It also occurs in cabbage, asparagus, artichokes, beetroot, haricots, tomatoes, celery, potatoes, and even bread; it is found in dry figs, in plums, gooseberries, strawberries, raspberries, oranges, lemons, and cherries; it is present in considerable quantity in pepper, in black tea, and in cocoa, and, in less quantity, in coffee and chocolate. Many other less common articles of food are mentioned as containing it in minute quantity. It seems, therefore, very probable that the poor, who live much on vegetable food and who drink large quantities of tea, may introduce an excess of oxalates with their food, and so determine the deposition of oxalate of lime in the urine. The food, however, is not the only source of urinary oxalates, for it has been shown that if all oxalates are excluded from the food, some will be formed in the process of metabolism.

Some have suggested that oxalic acid is derived from uric acid by a process of oxidation; others that it originates from incomplete oxidation of starchy, saccharine, and fatty foods, of which, however, there seems to be no kind of proof; and others that it is due to changes in the mucus of the urinary passages, or to decomposition of uric acid by the action of certain ferments in the urine. Its appearance in the urine has been said to coincide with the development of a particular form of dyspepsia in ill-nourished, over-worked persons, accompanied by pain or weight across the loins, irritability of the bladder, great muscular languor, general debility, emaciation, nervousness, and great depression of spirits. Probably in some subjects disorder of gastric or intestinal digestion does lead to excess of oxalates, or favour their deposition in the urine, even if not actually in excess. However, the chief clinical significance of excess of oxalates in the urine is the risk of the deposition of crystals of oxalate of lime in the urinary passages and the formation of calculus. The passage of a single large crystal will occasionally excite typical renal colic, followed by the appearance of blood in the urine from wounding of the ureter. The precipitation of crystals of oxalate of lime, *long after the urine has been passed*, is not necessarily of any pathological significance, and may be simply the result of decomposition of the urine.

It is, perhaps, of some practical importance to know that these crystals are most frequently found in highly acid urine. They are said to be usually abundant in cases of spermatorrhœa, and in paroxysmal hæmoglobinuria.

It will be seen that we have clear causal indications for **treatment** in these cases; these will be (1) to prohibit the taking of foods that are unduly rich in oxalates; (2) to correct any disorders of digestion; (3) to modify the condition of the urine, so that it may not be favourable to the deposition of oxalate of lime. Alimentary substances known to contain oxalic acid should be prohibited. The chief of these we have named. Tea should be especially avoided, and alcoholic drinks also. Milk and eggs are forbidden by some on account of their richness in lime salts. In the case of milk, however, we consider this is more than compensated by its diuretic property. A nourishing diet, composed of an adequate quantity of animal food of digestible quality and suitable preparation, is an important point to be insisted upon. Cantani found that an exclusive meat diet greatly diminished the urine of oxalates.

Such general hygienic measures should also be enforced as are calculated to restore both mental and bodily health: cold sponging, followed by friction of the skin, plenty of outdoor exercise, at the seaside or in mountain or country resorts, rest from fatiguing or exciting occupations, and, when possible, freedom from worry.

Co-existing dyspeptic conditions must be treated on the general principles already laid down. If there should be chronic gastro-intestinal catarrh, much benefit may be found in drinking three-quarters of a pint of hot water, containing 2 or 3 teaspoonfuls of Carlsbad salts dissolved in it, about an hour or half an hour before breakfast every morning, and a glass of Vichy or Apollinaris water at bed-time. Good results have followed, in some instances, the prolonged use of Contrexéville water, both at the spa itself and at home. It is true that Contrexéville water contains a considerable quantity of lime salts, but it is the actual bulk of water taken that is the agent of chief importance. It is usual at the spa to order such patients to drink about 2½ litres (4½ pints) of water daily. It is well to bear in mind that such large quantities of mineral waters are by no means well tolerated by feeble and debilitated persons. Simple dilution of the urine, by drinking freely of plain water, and preferably in the intervals between meals, will help to keep the oxalates in solution.

The bowels should be kept freely open by suitable aperients. Nitro-hydrochloric acid seems to be one of the most useful medicines in this malady, and 20 minims of the dilute acid, mixed with some bitter infusion, may be given soon after food twice or thrice daily; we may often usefully combine with this 10 to 15 minims of tincture of nux vomica, or 3 or 4 minims of liquor strychninæ, or a grain or two of quinine may be added to each dose, or 5 to 10 grains of the citrate of iron and quinine. The salts of magnesium are often given in oxaluria, with a view to replacing the calcium element, and so producing a more soluble form of oxalate. Friedrichshall, Hunyadi Janos and Æsculap mineral waters are all suitable; or half an ounce to an ounce of the official liquor magnesii carbonatis may be taken in a tumbler of hot water every morning on rising. Acid sodium phosphate has the same effect, and an increase in this is one of the results of a liberal allowance of animal food. Although alkalies are not of the same use in these cases as in uric-acid gravel, still they are sometimes of service; and Sir William Roberts had seen good arise from small doses of potassium bicarbonate, and he had seen crystals of oxalate of lime disappear by rendering the urine freely alkaline; crystals of oxalate of lime deposited in an alkaline urine tend to be smaller than those deposited in an acid medium. The main object of treatment is to restore the digestive and general tone.

PHOSPHATURIA

Phosphoric acid is excreted in the urine either in combination with sodium and potassium, or with calcium and magnesium. It is this latter form of *earthy phosphates* that may be thrown down, when the urine is either neutral or alkaline.

There are two forms of phosphatic deposit which occur in *alkaline* urine: (1) amorphous phosphates of calcium and magnesium; (2) the crystalline calcic or stellar phosphate, and the double ammonio-magnesium phosphate. The first is of little clinical significance; it is a white deposit ("white gravel") thrown down in neutral or alkaline urine. Such a deposit is not uncommon even in health during the "alkaline tide" of the urine that occurs during digestion from the liberation of bases due to the formation of free acid in the stomach. This precipitation sometimes takes place in the bladder, and the phosphates are discharged at the end of micturition as a whitish fluid, which is sometimes mistaken for spermatorrhœa. Calcium phosphate is often precipitated on heating the urine of persons in health. It is distinguished by being dissolved by acetic acid. This form of phosphatic deposit very rarely leads to the formation of calculi, for the amorphous phosphate of lime has scarcely any tendency to form solid masses. The presence of this deposit in the urine ought not to be regarded as evidence that it is excreted in excess. To prove that, it would be necessary to make a quantitative analysis of all the urine passed in twenty-four hours. Teissier has described a condition in which there is persistent excess in the output of phosphates, and has termed it "phosphatic diabetes." It is apt to go hand in hand with polyuria, and sometimes with glycosuria as well, while gastric and neurasthenic disturbance is pronounced. Probably some of the excess is due to nervous disturbance of the digestive function, but part also to the inordinate hunger that is apt to accompany the condition. The indications for the **treatment** of this form of urinary deposit depend on the morbid conditions with which it is associated. If it seems to depend on an excess of vegetable acids in the food we must diminish the amount of vegetable food. Sometimes we shall find that patients habitually take small doses of alkalies; then this habit must be checked. Dyspeptic and neurasthenic symptoms should be treated by general hygienic measures, suitable food, change of air and scene, moderate regular exercise, and cheerful occupation. Mineral acids are of little direct value, but may assist usefully as general tonics.

It is different with regard to the phosphatic deposit determined in urine by *ammoniacal* fermentation of urea, as observed in cystitis, which appears to be due to the introduction of a **bacterial** ferment.

This is the *triple* or *ammonio-magnesian phosphate* found in decomposing urines. These phosphates are prone to concrete together and so form a considerable part of many calculi. Such calculi are usually formed in the bladder, and this deposit may even cover the mucous membrane of the bladder itself. The mode of entrance of the bacterial ferment into the bladder upon which this ammoniacal decomposition of urea depends is not always clear; it has undoubtedly been often introduced by the passage of catheters which are not clean and aseptic. Certainly stagnation of urine in the bladder favours this decomposition, and when once established, if the bladder cannot completely empty itself, there is always a residue of putrid urine to excite the same process in that afterwards secreted. If cystitis does not already exist, the presence of this ammoniacal urine in the bladder readily excites it, and pus becomes mixed with the excretion.

The **indications for treatment** in these cases are (1) to thoroughly cleanse the bladder of its decomposing contents and (2) to endeavour to prevent the further decomposition of the urine secreted.

(1) The bladder should be completely emptied of its contents by catheterisation when it is evident that micturition does not thoroughly empty it; but great care should always be taken, when introducing a catheter into the urethra or bladder for any purpose, to see that it has been made thoroughly clean and aseptic. The bladder may then be washed out with a warm solution of borax and boric acid—weak solutions of chloral and of carbolic acid have also been used. For dissolving phosphatic deposits in the bladder a very dilute nitric acid injection may be employed—1 dram of dilute nitric acid in 10 ounces of warm water. (2) To prevent the further decomposition of the secretion, anti-fermentative drugs must be given. Sodium benzoate, in 10- to 15-grain doses three times a day, answers well. Whitla says he has found 8- to 10-grain doses of boric acid by the mouth of "surprising" efficacy. We have ourselves found salol very useful in these cases. It has been stated that *benzoic acid* has the property of indefinitely postponing the occurrence of alkaline fermentation of the urine, and consequent cystitis, by its distinct bactericidal power; *urotropin* also appears to have a powerful influence of the same kind. Hutchison considers acid sodium phosphate the most powerful drug we possess for rendering an alkaline urine acid. A convenient plan is to dissolve 2 drams in a pint of water, and allow the patient to drink small quantities of this from time to time; half an ounce or an ounce may be given in twenty-four hours. It is a useful adjuvant to urotropin, which acts best in an

acid urine. If any diarrhœa results the amount can be diminished. Sir William Roberts has advocated drinking large quantities of fluid at regular intervals and encouraging regular micturition, so as to keep the bladder washed out with the renal secretion. Buchu, santal, juniper, turpentine, resorcin, and many other drugs of this class, have been used by different physicians with more or less success.

Hæmaturia

Blood may appear in the urine in a variety of circumstances.

A frequent cause is the presence of a calculus in the kidney or urinary passages, producing laceration of the blood-vessels ; when there is a small calculus in the kidney any jolting movements of the body, as in riding or driving, or any sudden jar, may determine the occurrence of hæmaturia. Blood may also be poured into the urinary passages from laceration of the kidney or rupture of blood-vessels in the urinary tract from external mechanical injury, as in falls on the back, railway accidents, etc.

Congestive or inflammatory states of the kidney, bladder, or urethra may also lead to the presence of blood in the urine, as in acute Bright's disease ; embolic infarcts from ulcerative endocarditis, when lodged in the kidneys, also lead at times to the escape of blood with the urine.

New growths, such as cancer, and tubercle in the kidneys or bladder, and villous growths in the bladder, cause hæmaturia.

The so-called " endemic " hæmaturia which occurs in Egypt and elsewhere is *parasitic* in its nature, and attributable to infection by the *bilharzia hæmatobia.*

Hæmaturia may also depend on some general morbid blood state, as in purpura, scurvy, malarial fever, small-pox, etc. There are also the toxic forms, dependent on the introduction into the blood of matters peculiarly irritating to the kidneys, as cantharides, turpentine, and, in some rare instances, quinine.

Finally, in some cases it may occur without the existence of any discoverable cause.

Certain cases of this kind have been termed "*renal hæmophilia*" and "*vaso-motor hæmaturia*," and referred to an *angio-neurosis* of the kidney. Several such cases have been recorded where no cause could be ascertained even after nephrotomy and nephrectomy, but a large proportion of these cases were cured by operation! *

There can rarely be any difficulty in the detection of the presence of blood in the urine—in moderate or large hæmorrhages the colour is sufficiently characteristic; indeed, the urine often looks like pure blood; the microscope, however, must be used to distinguish hæmaturia from hæmoglobinuria.

It is often important to determine the **seat** of the hæmorrhage. It is as well to bear in mind that in women the blood may come from the uterus. If during micturition it can be observed that the flow of blood comes only at the beginning or the end of micturition, then it is pretty clear the blood must come from the urethra. The presence of flat blood clots in the urine points to their formation in the floor of the bladder, while cylindrical casts of the ureters indicate a higher origin, and blood casts of the uriniferous tubules point to their formation in the renal cortex and to the probable existence of acute nephritis. When the blood comes from the pelvis of the kidney it is always intimately mixed with the urine.

A dark brownish colour of the urine has also been regarded as affording presumptive evidence of a renal origin of the blood, some of the hæmoglobin having been transformed into methæmoglobin from prolonged contact with the acid urine. But in *profuse* hæmorrhage the acid is insufficient to produce this change. When the urine is pink or bright red this is due to alkaline reaction, and the bladder is probably the seat of the bleeding. But we shall often be compelled to employ the cystoscope or catheterisation of the ureters before we can determine the source of the bleeding.

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* *Clinical Journal*, February 22nd, 1899; and *Medical Annual* for 1901. "Surgical Diseases of Kidney," by Mr. Hurry Fenwick, p. 339.

Profuse hæmorrhage from the bladder, unaccompanied by other symptoms, is usually dependent on villous tumour or malignant growths.

Besides the presence of blood in the urine, we may have symptoms of renal colic from blood clot arrested in the ureters, or dysuria, from the presence of a large coagulum in the bladder.

After these preliminary etiological and other considerations, we may now pass on to consider the **treatment** of hæmaturia.

The indications are, first, to arrest the hæmorrhage, which may be in itself dangerous, although very rarely fatal; and secondly, to remove the cause, which, however, may not be possible.

The causal indications would lead us into the consideration of the treatment of the several different diseases of which hæmaturia may be a symptom. Some of these, as cancer and tubercle, are obviously incurable.

It should be remembered that drugs have been found to have less effect in this than in most other forms of visceral hæmorrhage.

When the bleeding is clearly due to the presence of renal calculus, *absolute rest* in the recumbent position, bland, cold, acidulous drinks, such as raspberry vinegar in iced water, or barley water with sliced lemon in it, or lemon whey, will usually suffice to arrest the milder forms. If there should also be pain and restlessness, we should give $\frac{1}{6}$ or $\frac{1}{4}$ grain of acetate of morphine subcutaneously.

We have no drugs that exert a direct hæmostatic influence in renal hæmaturia. Many vegetable astringents, such as hamamelis, have been recommended on account of the tannin they contain. This is converted in the blood into sodium tannate and sodium gallate, which have no astringent action. Still less can we look for a remote hæmostatic influence from the mineral astringents. We must rather depend on drugs that lower the general blood-pressure, without encouraging accumulation of blood in the abdominal splanchnic area. Such are the saline purgatives, and in a less degree diaphoretic drugs. Ergot is contra-indicated because it raises the blood-pressure. External applications may be occasionally of use, and ice-bags to the loins, when the hæmorrhage is from the kidneys, and to the hypogastric region when from the bladder, have been found useful. Dry-cupping to the loins in congestive or inflammatory cases is a good expedient, and if the bleeding should be traceable to a toxic irritant, like cantharides, warm fomentations may also be applied, together with the internal exhibition of aperients. We have little confidence in the use of diaphoretics, but in this connection it may be mentioned that Whitla has found tincture of jaborandi, in half-dram doses, of great value "in most forms of renal hæmorrhage."

When the hæmorrhage is from the bladder, the injection of astringent solutions into this organ is indicated after as complete removal as possible of its contents. The bladder should first be thoroughly washed out with a lukewarm saturated solution of boric acid, a large-eyed catheter being used, so as to get rid of clots. Sometimes it will be necessary to attach some kind of suction apparatus to the catheter. One of the best astringents is a solution of alum, 2 grains to the ounce; or one of nitrate of silver, 2 grains to the ounce; or of hazeline diluted with twice as much water; or of adrenalin chloride (1 : 1000), ½ a dram to the ounce. An ounce or two ounces of any of these astringent solutions may be allowed to remain in the bladder. Another expedient is the injection of iced water into the rectum.

Hæmaturia occurring in the early stage of acute nephritis, or from acute congestive conditions, rarely needs any active interference for its arrest, beyond hot applications to the loins as already mentioned.

Solutions of gelatine have been employed in renal as well as in other forms of hæmorrhage, but experience has not convinced us of their utility.

HÆMOGLOBINURIA

In this case the urine has the same aspect as in hæmaturia, but on microscopical examination the red blood corpuscles are either absent or present in such insignificant numbers as to be out of all proportion to the amount of colouring matter. The urine is usually of a dark red or chocolate colour, much of the hæmoglobin having been converted into methæmoglobin, the characteristic absorption bands of which may be seen with the spectroscope. It commonly throws down a sediment of dark brown lithates, and oxalate of lime crystals are also often deposited. It is believed that the hæmoglobin is set free in the blood before its excretion in the urine.

Three forms of hæmoglobinuria have been described: (1) *paroxysmal;* (2) *toxic;* and (3) an epidemic *infantile* hæmoglobinuria, a rare condition, described by Winckel of Dresden, and probably due to some specific virus.

It is the first or *paroxysmal* form that chiefly concerns us now. This is a rare and remarkable malady. The *causation* of this disease is often obscure, but in most cases the *exciting* cause, at any rate, appears to be exposure to *cold.* The attacks will often cease during the warm season and return in the cold season. A cold foot-bath has brought on an attack in a patient subject to them. Bodily or mental fatigue, especially when combined with cold, is provocative of attacks. It has been thought to be closely related to malaria, but this is doubted by Osler and others. It has been observed in association with syphilis, and in cases resembling Raynaud's disease. It is far more common in men than women.

The attacks are often preceded by chilliness and languor, and coldness and blueness of the hands and feet. Sometimes there is pyrexia, but more frequently the temperature and the pulse are subnormal. Jaundice is sometimes present. Pain across the loins is sometimes complained of. The hæmoglobinuria rarely lasts more than a day or two, and cases have been seen in which there were two or three attacks in a day, the urine becoming clear in the intervals.

It has been suggested that the disease originates in "an undue sensitiveness to cold on the part of certain of the red blood-discs" (*Fagge*), which then allow their hæmoglobin to escape into the blood serum.

The **treatment** of the paroxysmal affection mainly consists in protecting those who are subject to it from cold and fatigue, and especially from exposure to cold *when* fatigued. Residence in a warm climate in the winter is most desirable when practicable. During an attack, the patient should be put into a warm bed and given some hot soup. Pain in the back may be relieved by mustard poultices over the lumbar region and by extract of henbane, as recommended by Druitt, who himself suffered from this malady. Occasionally the pain is sufficient to justify an injection of morphia at the outset. The daily routine of life should be so arranged that the subject of these attacks should always be well nourished by suitable food and at suitably-arranged meal-times. He should never be exposed to any exhausting efforts, physical or mental. He should be very warmly clothed, and the hands and feet should be especially cared for in this respect.

Alcoholic drinks appear to be injurious; but a cup of hot beef-tea on waking in the morning has been said to prove an effectual preventive. Quinine in full doses has been found by some physicians to be capable of warding off the attacks; but in some cases it seems to be useless, even when taken in very large doses.

Ammonium chloride, salicin, iron, and arsenic have each had their advocates. It is said that amyl nitrite will sometimes cut short and prevent attacks. In syphilitic cases, potassium iodide and mercuric chloride have sometimes produced a cure.

The **toxic** form is caused by such poisons as produce rapid dissolution of the blood corpuscles, and it is only of interest to us now in order to set us on our guard as to the detection and removal of such causes. Large doses of potassium chlorate, carbolic acid, pyrogallic acid, arseniuretted hydrogen, carbon dioxide, naphthol, muscarin, and also the poisons of malaria, yellow fever, scarlet fever, typhoid fever, and syphilis, have all been found, at times, capable of producing hæmoglobinuria. Transfusion of blood from one mammal into another will sometimes be attended with this symptom.

CHYLURIA

This term is applied to the presence in the urine of a chylo-serous effusion, giving it the appearance of milk, from the presence of fat in a fine state of subdivision. Occasionally it is tinged pink by the presence of red corpuscles in an elementary stage of development in the lymphatic system. On standing, the fibrinous material soon forms a firm coagulum.

The presence of chyle in the urine no doubt arises, in most cases, from a communication becoming established between distended lymph vessels, connected with the lacteals of the small intestine, and some part of the urinary tract. It is usually regarded as dependent upon blocking of some of the lymphatics by the immature ova of the *filaria sanguinis hominis*, or by the parasites themselves; but undoubtedly blocking of the lymphatics by other means, such as the pressure of a tumour, may also lead to chyluria. The parasite commonly enters the human subject in the bite of the mosquito, but also in drinking water.

The prophylactic measures against the introduction of this parasite into the body, when living in countries where it is known to exist, consist in the adoption of the usual precautions against mosquito bites, the destruction of their larvæ, and the draining of their breeding-pools; also in not drinking water that has not been previously boiled, unless we are absolutely sure of its purity, and in thoroughly washing all raw vegetables before consumption with water that has been boiled. At present we have no means of destroying the parasite in the blood-vessels. Rest in bed, diminution of fat in the diet, and gentle saline purgation are the most serviceable remedies. Astringents have been given internally, and injected into the bladder, with the idea of closing the communication between the lymph-channels and the urinary passages, and some success is said to have attended their use. Bence Jones and Waters found gallic acid cause the disappearance of the chylous aspect of the urine; it has been given by the mouth in doses varying from 30 to 130 grains daily. Nitrate of silver, acetate of lead, and mineral acids have also been used. Good results have been claimed for large doses of iodide of potassium. *Thymol* has been given, in doses of 1 increased to 2 grains—it has been said with the disappearance of *filaria* in a few weeks; but Manson discredits this statement entirely.* Should the urine coagulate in the bladder, as it has been known to do occasionally, and so cause retention, as large a catheter should be passed as possible, fitted with an aspirating syringe, and the coagulum should be broken down by the alternate injection and withdrawal of a warm solution of sodium bicarbonate.

ALBUMINURIA

The occurrence of albumen in the urine, as a symptom of Bright's disease, will concern us when we are dealing with the treatment of that affection; at present we propose to limit our observations to the occurrence of albumen in the urine independently of the existence of any serious organic change in the kidneys. Nor are we now concerned with the albuminuria which occurs in the course of most acute infectious diseases, as in diphtheria and typhus, or in that which depends on passive engorgement of the kidneys from respiratory, circulatory, or mechanical obstruction, as in advanced pulmonary emphysema, cardiac disease, or abdominal tumours; nor in that which may be caused by overdoses of certain drugs. Albumen in the urine may occur in these and other morbid conditions without presenting any therapeutic indications; it is simply a symptom or accident of the disease with which it is associated, and it is only in this association that it can be profitably considered.

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* "Tropical Diseases" (4th edition), 1907.

But albumen is occasionally found in the urine of persons **apparently healthy.** To this condition the terms "physiological" and "functional" albuminuria have been applied. Both these terms are faulty; the term "physiological" rests on an assumption for which there is certainly no solid foundation; the term "functional" is an unsafe one, because it conveys an *opinion* instead of merely stating a fact. It is most commonly met in adolescent males, and has a tendency to disappear in adult life. Probably in every instance there is some disturbance of nutrition of the glomerular epithelium. After twenty years of daily examination of candidates for life assurance, chiefly amongst the middle classes, of all ages from 17 to 70, we have exceedingly rarely, if ever, encountered albuminuria in a person who was *in every respect* in sound and vigorous health. It occasionally occurs in weedy young men who are indulging in habits inconsistent with their physique—either in athletic exercises beyond their natural capabilities, or in what is, for them, sexual excess (although it might not be for their more robust companions); or they are consuming too much tobacco and lowering the cardiac tone. In schoolboys, and in other youths also, its occurrence may constantly be traced either to masturbation, to exposure to cold, or to excessive physical exertion. When it depends on diminished circulatory tone ("vascular asthenia" Sir William Gull used to term it) from physical exertion, it is remarkable how small an amount of exercise in some persons will determine it. We made some observations in the case of a gentleman who was accidentally discovered to have albuminuria on being examined for admission to a yeomanry regiment. In this case we demonstrated that it was not "cyclic," although it might be said to be "intermittent"; but it was always most manifest after his morning walk when he returned home to lunch; it was much less manifest on rising in the morning, *and after dinner*, at which he drank a pint of claret, it would entirely disappear. When the circulatory tone was raised by rest and food and wine the albuminuria disappeared.

The presence of albumen in the urine is so habitual after severe or protracted exertion, even in the strong and healthy, that one is almost driven to admit that it may be truly "physiological." But profound circulatory stress may through vaso-motor agency produce such a disturbance of nutrition of the glomerular epithelium, albeit transitory, as to make the name inapplicable.

Posture appears to be the most constant and potent factor in producing functional albuminuria. The transudation of albumen seems to be due to increased hydrostatic pressure in the renal capillaries. Thus albumen may be absent from the urine passed immediately on rising in the morning, and will reappear within a few minutes of assuming the erect posture. These cases are spoken of as "postural" or "orthostatic," but it would certainly be a mistake to extend this term to the whole group.

In other cases in which intermittent albuminuria has been observed, it appears to have been traceable to chill, to taking a cold bath or remaining too long in it, or exposing the surface of the body to cold air.

Great excess of albuminous food may produce a "dietetic albuminuria," but whether dyspeptic conditions can of themselves produce albuminuria is a matter for doubt; that the occurrence of albumen in the urine, in the class of cases we are considering, is limited to the period of digestive activity is, we think, an erroneous conclusion.*

It is, of course, important, in connection with this matter, to remember that the urine may frequently be found to contain a trace of albumen from the presence of mucus or blood from other sources than the kidneys; the admixture of a little prostatic fluid or urethral mucus in men, or vaginal discharges in women, will often cause urine to give this reaction. It is rare to obtain a specimen of urine from the female in which this is not the case. The microscope will then often enable us to identify the peculiar cellular elements. Of so-called "emotional" albuminuria we have no knowledge: that following an epileptic seizure is probably due to great muscular exertion.

Recently Wright has suggested what is at times a valuable means for distinguishing functional albuminuria from that due to organic disease of the kidney in his observation that the administration of calcium salts checks the output of albumen in the former but not in the latter condition. This he attributes to their power of increasing coagulability of the blood, so that its albumen transudes less readily. This result may often be obtained within twenty-four hours of administration of a single dose of 60 grains of calcium lactate. In some cases as much as 19 days elapsed, with 20-grain doses, repeated three times a day, before the albumen disappeared.

The successful **treatment** of these conditions depends on seeking out the cause and adopting measures to remove it; the daily loss of a small quantity of albumen is not in itself a matter of serious moment. As a method of treatment the employment of calcium salts will only be desirable in those rare cases in which the loss of albumen is in itself sufficient to impair the health; it is necessary to look to the remoter cause that has led to undue permeability of the renal epithelium. When it is due merely to anæmia or loss of tone, to "vascular asthenia," and occurs chiefly after exercise or exertion, it should be treated by general tonic measures.

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* The relation of albuminuria to food is discussed in the author's work on "Food in Health and Disease," p. 432.

Physical exercise should be limited to such only as is necessary to health; gentle walking or riding exercise may be permitted, always stopping short of any fatigue. It is, therefore, better to recommend that the daily exercise should be taken in repeated short walks or rides rather than in one or two long ones, and that the exercise should be taken, not in the early or late hours of the day, but chiefly in the afternoon, an hour or so after the mid-day meal. The food should be light but nutritious, and contain a due amount of digestible animal food. There is no need, nor is it desirable, to exclude animal albuminates from the dietary. Some sound Burgundy or other suitable wine may be taken at meals, diluted with a little water.

As a tonic, a combination of iron, quinine, and strychnine is most useful; we are in the habit of prescribing 10 to 20 minims of the tincture of the perchloride of iron, 1 to 3 grains of sulphate of quinine, and 3 to 5 minims of the solution of strychnine in an ounce of chloroform water thrice daily, about two hours after a meal.

In cases in which there is reason to believe that the albumen is dependent upon a dyspeptic state, with a tendency to hepatic congestion from overfeeding or too great a consumption of animal food, then we should counsel a more liberal use of vegetable food, together with milk, and we should forbid eggs, and limit the nitrogenous food taken to a little fish or white meat. At the same time the bowels should be kept freely open by some saline aperient, such as 3 or 4 ounces of Apenta water or Carlsbad salts, 2 or 3 teaspoonfuls in a tumblerful of warm water, taken in the morning fasting. The action of the skin should be promoted by hot or Turkish baths, with free friction of the surface. A certain amount of regular, moderate exercise should also be enjoined.

If the albuminuria should appear to be due, as it has been suggested it may be in dyspeptic persons, to the irritation of the urinary mucous membrane by crystals of oxalate of lime or uric acid, the free ingestion of hot water containing some alkaline salt in solution should be ordered. A claret-glass of warm Vichy water may be taken half an hour before each meal and at bed-time; or, what answers as well, a glass of warm water, containing 10 or 15 grains of potassium bicarbonate in solution, and made to effervesce with a teaspoonful of lemon-juice.

Co-existing dyspeptic symptoms must, of course, be treated in the ordinary way.

For the albuminuria observed in schoolboys and adolescents, we would counsel a careful inquiry into habits, with a view to correcting any vicious tendency that may possibly be found to exist; we should forbid all athletic exercises for a time, and restrict the diet chiefly to milk and vegetable food; we should inquire if any digestive troubles exist, and especially if there has been any inattention to the action of the bowels. School tasks should be light, and mental and physical rest insisted upon.

The cases that are traceable to exposure to cold suggest the insistence on warm clothing, and the avoidance of cold baths, cold bed-rooms, and standing about during out-door games, or other out-door pursuits, in cold weather.

Albuminuria in a child having an elongated prepuce has been relieved by circumcision. Whatever other measures may be desirable in the treatment of albuminuria will be considered in connection with the treatment of the several forms of Bright's disease.

ADDITIONAL FORMULÆ

For lithiasis

℞ Lithii citratis, gr. x.
Acidi citrici, gr. xx.
Syrupi aurantii, ʒss.
Aquæ ad ℥ij.

M. To be taken in effervescence with 14 grains of sodium bicarbonate dissolved in 2 oz. of water. (*Guy.*)

Pills for lithiasis

℞ Sodii carbonatis exsiccati, gr. xlv.
Extracti gentianæ, gr. xlv.
Saponis, gr. xlv.
Pulveris zingiberis, gr. xlv.

M. et divide in pil. centum. Five to ten daily. (*Ewald.*)

Mixture for the same

℞ Liquoris potassæ, ʒij.
Tincturæ serpentariæ, ℥j.
Syrupi zingiberis, ℥ss.
Infusi serpentariæ ad ℥xij.

M. f. mist. Three tablespoonfuls twice a day. (*Paris.*)

Another

℞ Sodii bicarbonatis, ʒjss.
Acidi benzoici, gr. xl.
Sodii phosphatis, ʒiij.
Tincturæ hyoscyami, ℥ss.
Aquæ cinnamomi, ℥viij.
Aquæ ad ℥xij.

M. f. mist. Two tablespoonfuls three times a day. (*G. Bird.*)

In oxaluria with debility

℞ Acidi nitrici diluti, ♏v.
Acidi hydrochlorici diluti, ♏v.
Infusi serpentariæ, ℥j.

M. f. haust. To be taken three times a day. (*G. Bird.*)

Mixture and pills for oxaluria

℞ Acidi nitrici, ʒj.
Acidi hydrochlorici, ʒiij.
Aquæ camphoræ ad ℥iv.

M. f. mist. A teaspoonful in a wineglassful of infusion of camomile three times a day.

℞ Pilulæ hydrargyri subchloridi compositæ, gr. v.

F. pil. To be taken every night. (*G. Bird.*)

For lithiasis

℞ Potassii bicarbonatis, ℥jss.
Acidi citrici, ℥j.
Aquæ, ℥xij.

M. f. mist. Two tablespoonfuls with twice as much water for a dose. (*Picard.*)

CHAPTER II

TREATMENT OF RENAL CALCULI — HYDRONEPHROSIS — PYURIA AND PYELITIS — CYSTITIS

The occurrence of *Renal Sand* or *Gravel*—Composition of Renal Calculi—Causation of Calculi—Symptoms of Renal Calculus.
RENAL COLIC. *Indications for Treatment*—In the *Paroxysms*—Morphine Hypodermically—Chloroform or Ether Inhalations—Hot Drinks—Hot Baths—Enemata of Chloral, or of Opium and Belladonna—In the *Intervals*—Courses of Mineral Waters—Solvent Treatment—Surgical Treatment.
HYDRONEPHROSIS. Causes—*Treatment*.
PYURIA AND PYELITIS. Causes—Symptoms—"Pyonephrosis"—Perinephritic Abscess—*Treatment*. Cases of *Cystitis*.
Additional Formulæ: Glycerine in Uric Acid Calculi.

As the most common cause of pyelitis, and of the presence of *pus* in the urine, is the existence of **renal calculus**, it will be convenient to consider, in the first place, the treatment of renal calculi and their consequences, so far as they, directly or indirectly, concern the physician.

We have already seen, in considering the subject of the occurrence of certain crystalline deposits in the urine, that the chief danger in the tendency to these depositions is, lest they should occur in the urinary passages and form calculi. It is to the deposition of certain of the solid constituents of the urine, as concretions within the pelvis and calices of the kidneys, and the symptoms and conditions arising therefrom, and the best methods of treating such states, that our attention must now be directed.

Such concretions occur in various forms; they may simply appear as small, gritty particles, as mere grains of *uric acid*, or they may be of the size of coarse sand, and such collections of *renal sand* or gravel may be passed with the urine, again and again, without giving rise to any serious symptoms, or at most a little smarting during urination, as the individual particles are not large enough to be arrested in their passage along the urinary tracts.

But larger concretions also form, varying greatly in size, and the largest are apt to remain in the pelvis of the kidney, and give rise to serious symptoms from their presence there, and others may (and this is especially the case with the smaller concretions) pass into the ureters, and, during their passage along those ducts, give rise to agonising attacks of **renal colic.** Such small concretions may be numerous, and then they are often rounded and smooth, and patients will be found to pass considerable numbers of such small rounded calculi again and again. Single calculi are, perhaps, more apt to be angular and irregular, having the aspect of an agglomeration of crystals, and these, doubtless, give rise to the severest attacks of pain in their passage. In some rare cases calculi of large size form in the pelvis of the kidney, and become moulded, as it were, to its cavity, and project also into the ureter and block it.

Renal calculi are most commonly composed of *uric acid* mixed with urates; these are of a light reddish or fawn colour, and have usually a smooth surface; others are composed of *oxalate of lime* and uric acid; they are of very dark colour and rough surface (hence termed "*mulberry* calculi"). Phosphatic calculi are rare in the kidney; they are usually formed in the bladder, the phosphates being deposited around a nucleus of uric acid or oxalate of lime. We have already considered the conditions which lead to the precipitation of these deposits in the urine.

It is important to remember that in patients who pass *acid* urine, the only concretions likely to be met with are those which depend for their formation on the deposition of uric acid or oxalate of lime, and that phosphatic calculi are usually associated with the occurrence of alkaline urine, and occur as a deposition upon a pre-existing nucleus of uric acid or oxalate of lime.

It is, therefore, against the precipitation of these substances that protection is needed.

It is difficult in many cases to offer a satisfactory account of the origin of calculi. It has been suggested that drinking "hard" water—water saturated with lime salts—favours their occurrence, and no doubt such water cannot so well perform its solvent functions within the body as water which is quite pure.

For further considerations on the ctiology of such deposits, we must refer to what we have already said under Lithiasis, Oxaluria, and Phosphaturia. Patients may pass gravel for years with only the slightest inconvenience—perhaps no more than a little burning pain during urination.

The symptoms and common consequences of renal calculus are the following: (1) pain in the loins, usually on the affected side only, especially excited by jolting or shaking of the body; (2) local tenderness on pressure over the affected kidney in the loin or on its anterior aspect; (3) hæmaturia, rarely profuse or constant, and subsiding on complete rest in bed; (4) renal colic; (5) anuria or hydronephrosis from obstruction of ureter.; (6) pyelitis. Hæmaturia and its treatment we have already considered. *Pain in the back*, when not associated with other symptoms of renal colic, and when not attended with hæmaturia, is sometimes, perhaps rather vaguely, referred to renal irritation from highly acid urine, or from some crystalline deposit in the pelvis of the kidneys, and if this "lumbago" is found to coincide with the passage of highly acid urine freely depositing lithates, and if it is found to be relieved by the administration of alkalies, this view of its causation may be correct. At any rate no harm can arise from treating this symptom, when accompanied by such urine as we have described, by the free exhibition of dilute alkaline drinks. It should be borne in mind that the pain of renal calculus is especially prone to extensive transference to distant regions along the course of the branches of the lumbar plexus—the testicle, the upper part of the thigh, the leg, and inside of the foot, and sometimes it is felt severely in the course of the sciatic nerve.

One of the most serious and painful consequences attending the existence of renal calculi is paroxysmal attacks of *renal colic.*

RENAL COLIC

An attack of renal colic is produced by the entrance of a urinary concretion into the ureter. Its onset is frequently sudden and violent, and the pain is often most agonising. It may occur when the patient is at rest, or it may be induced by some jarring movement or muscular effort. The pain usually starts from one loin, and extends downwards along the course of the ureter; it may radiate more widely over the abdomen, and is sometimes felt chiefly in the iliac region; it commonly shoots into the corresponding testicle, which is often retracted and tender, and the pain may be felt along the inner side of the thigh. The intensity of the suffering causes the patient to turn deadly pale, and drops of perspiration break out on his forehead. There is also often a feeling of chilliness, almost amounting to a rigor, the pulse is small and feeble, the breathing hurried, and the temperature sometimes rises; nausea and vomiting frequently, but not always, accompany the attack. The patient often adopts strange positions to relieve his sufferings. Some cessation of pain may occur from time to time throughout the paroxysm, but it returns again and again, until after a variable duration the paroxysm may suddenly cease with the escape of the stone into the bladder. The amount of suffering probably depends greatly on the form of the calculus and the character of its surface rather than on its size; a smooth, round, uric-acid calculus may give far less pain in passing along the ureter, although twice or three times the size, than one of oxalate of lime with a rough, uneven surface. The urine, which is usually passed frequently and with pain, often contains blood.

Recurrent attacks of this kind are sometimes encountered without any evidence that a calculus has passed from the kidneys into the bladder ; in such cases it is probable there is a stone in the pelvis of the kidney, which from time to time passes into the upper part of the ureter, but being of too large a size to pass through that conduit, falls back again into the pelvis of the kidney. The passage of a clot of blood along the ureter may also give rise to an attack of renal colic. If the calculus remains in the kidney it usually gives rise to characteristic symptoms, of which *pain* in the back of a dull, wearing nature is the most constant ; it is commonly referred to the affected side, and pus, mucus, or albumen is found daily in the urine in varying quantity.

The **indications for treatment** in cases of renal colic *during the paroxysm* are : (1) to allay pain and spasm ; and (2) to further the passage of the calculus along the ureter by flushing the kidneys with bland, diluent, mildly alkaline drinks ; (3) and *in the intervals* to prevent the formation of fresh concretions and to promote the solution or painless discharge of those that remain.

The hypodermic injection of morphine ($\frac{1}{4}$ of a grain) with atropine ($\frac{1}{100}$th of a grain), every hour or two for three or four doses until relieved, is the best means at our disposal for the relief of violent pain and spasm. In slight cases, if seen at the onset, one injection will often be sufficient to induce sleep, and the patient will not unfrequently wake up free from pain ; but in recurrent or severe cases repeated doses will sometimes be necessary. Some alcoholic stimulant should, at the same time, be administered when these repeated doses of morphine are used, as they are apt to cause some cardiac depression. Before administering the injection, let the patient drink 8 to 16 ounces of hot water, or hot water with a little milk added, and 20 grains of sodium or potassium bicarbonate dissolved in it, and give him a like draught on waking from the morphine sleep. It is sometimes objected that morphia will increase the liability to impaction. There is no sufficient evidence of this, and to guard against it we always insist on the patient taking fluid freely.

In cases where full doses of morphine or opium are counter-indicated, as in most cases complicated with Bright's disease, we must have recourse to inhalations of chloroform or ether, and in slighter cases of renal gravel opium may be replaced by henbane, 20 to 30 minims of the tincture in an ounce of chloroform water, or full doses of spirit of chloroform. The hot bath, which is so highly extolled by some physicians for the relief of the spasm, should be employed as an auxiliary in protracted attacks, but it cannot take the place of morphine or chloroform. The same may be said of hot poultices and fomentations. Some patients find more relief from cold than from hot applications. If for any reason it should seem more desirable to administer remedies by the rectum, solution of chloral, or of opium or belladonna, may be given in the form of small enemata, or large enemata of warm water have been found soothing.

For the purpose of flushing the urinary passages and diluting the urine, the patient should drink freely of warm barley water, or of hot milk and Vichy water, in the proportion of 1 part of the former to 4 of the latter, or of a mixture of equal parts of warm lemonade and potash water, at choice.

Inversion of the patient and shaking are said to have been occasionally attended by immediate cessation of pain.

Highly important also is the **treatment in the intervals** with the view to preventing the formation of fresh concretions (*see* Oxaluria, Phosphaturia, Lithiasis). Further, we must aim at dissolving or promoting the painless discharge of such as may remain in the kidneys.

It is for this purpose that patients who suffer from renal colic are sent to drink mineral waters at Vichy or Ems, or at Contrexéville, Vittel, or Evian. The former are alkaline waters, the latter are waters which, we believe, act chiefly mechanically and by their diluent quality. The latter are usually administered in very large quantities when it is desired to procure the expulsion of calculi from the pelvis of the kidney.

Patients at either of these spas will often be found to pass numerous small uric-acid concretions, in some cases year after year, and not unfrequently concretions also of considerable size are got rid of; this is especially the case at Contrexéville.

There is some difference of opinion as to the possibility of exerting any solvent action on urinary concretions within the body. Sir William Roberts believed that this was possible in the case of uric-acid concretions (as uric acid is soluble in alkaline solutions), if we give alkaline drinks in sufficient quantity and for a sufficient length of time. The urine must be kept continuously alkaline for long periods. In order to effect this, the following mixture should be prescribed:—

℞ Potassii bicarb.		10 drams.
Acidi citrici		7 „
Aquæ destill.	ad	10 oz.

M. f. mist.

From half an ounce to an ounce of this mixture (equal to 60 grains of potassium citrate) should be given in a claret-glass of water every three hours for several months. Potassium acetate seems to agree better with some patients. The reaction and density of the urine should be frequently tested, especially the morning urine, which is most prone to become acid. The density should be kept low by increasing, when needful, the intake of water.

If we have reason to believe that we are dealing with a phosphatic calculus, it would be undesirable to keep the urine alkaline over a long period, as that would tend to encourage the deposit, and so increase the size of the stone.

With regard to the value of the recently-introduced "solvents" of uric acid, such as *Piperazin*, much difference of opinion exists. Professor N. S. Davis, jun.,* thinks it "certainly efficacious." He believes "it increases the oxidation of excrementitious matter and makes uric acid soluble," that it "lessens its formation and aids its elimination," that it dissolves "uric-acid sand, and sharp corners of even larger stones can be smoothed." One of his patients, who suffered from uric acid gravel, "passed smooth stones whenever piperazin was used for some time (45 grains daily), and angular, acicular stones when it was not employed." In our own practice we rarely use it on account of its occasional depressing effects, and because we find we get quite as good results with the alkaline salts of the organic acids.

The diet should be carefully regulated on the lines already laid down in treating of Lithiasis, Oxaluria, and Phosphaturia, respectively.

When there is clear evidence of the presence of a stone impacted in the ureter or kidney, and giving rise to painful and exhausting symptoms which are otherwise irremediable, surgical measures must be resorted to for its removal. Great assistance both in diagnosis and treatment may be offered by the X-rays.

According to Henoch, *children* suffer frequently from renal calculi, but suffer much less pain in their passage down the ureter than adults. They are usually males, of gouty parentage, and the calculi are composed of uric acid. He treats their attacks with hot baths, fomentation to the affected side, and a mixture composed of ammonium bromide, sal volatile, and compound tincture of camphor.

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* Hare's "System of Practical Therapeutics" (new edition), vol. ii., p. 501.

HYDRONEPHROSIS

This term is applied to an accumulation of watery fluid in the pelvis and calices of the kidney, due to obstruction, and it may, therefore, be caused by the impaction of a renal calculus in the ureter. Obviously other pathological conditions may lead to obstruction of the ureter, such as stricture from congenital malformation, or from cicatrisation of an ulcer of its mucous lining, or external compression, by pelvic or other tumours. Moreover, bilateral hydronephrosis may arise from compression or obstruction of both ureters by pelvic cancer or peritonitis, or from obstruction lower down and dependent on urethral stricture, prostatic enlargement, or disease of the bladder itself.

But the most common cause of unilateral hydronephrosis is impacted renal calculus; and in such cases, if the obstruction is gradual or incomplete, the distension of the kidney and atrophy of its substance may reach an extreme degree, so that it is finally converted into an enormous cyst, which is apparent as a large tumour in the region of the kidney. Such a tumour may occasion some difficulty in diagnosis, and in the female especially may be mistaken for an ovarian cyst. Aspiration of a portion of the fluid may remove the difficulty, as the fluid from a hydronephrotic cyst nearly always contains some of the constituents of urine, such as urea and uric acid.

There are rare instances of *intermittent* hydronephrosis, usually due either to movable kidney or to impacted calculus with intermittent obstruction, in which, after the discharge by the urethra of a large quantity of clear fluid, the tumour suddenly disappears. After a time the sac refills, and the tumour reappears. There may be considerable pain when the sac is full, relieved at once by its discharge. These are the most hopeful cases, since it is clear that, whatever the nature of the obstruction, it is not insurmountable. It may be also as well to remember that the sac will sometimes discharge itself spontaneously through the ureter, and the fluid never re-accumulate. Intermittent hydronephrosis is almost invariably unilateral.

In bilateral cases, or in the event of the ureter on the sound side becoming blocked by a calculus, uræmia may supervene.

Many other points of pathological interest, associated with the development and history of these hydronephrotic cysts, do not concern us here, and we must now limit ourselves to a consideration of such **therapeutic** measures as they call for.

Unilateral hydronephrosis is rarely of itself fatal, spontaneous cure is not unknown, and its progress is often very slow, and we should, therefore, not advise active interference unless the patient is unable to bear the pain and inconvenience it causes. A pad and bandage will sometimes afford relief, especially in the intermittent form due to movable kidney. But if this fails, and the attacks are frequent and painful, we must consider the question of fixation of the kidney by nephropexy.

Sometimes the X-rays disclose a stone impacted in the ureter. We shall then advise its removal by operation, if other conditions are favourable. There is always the risk of infection of a hydronephrosis, converting it into a pyonephrosis.

Manipulation and compression of the tumour through the abdominal wall have occasionally led to its dispersion. Such manipulations should, however, be practised with very great care, lest rupture of the sac should be produced.

But when the sac is tense and painful it is sometimes permissible, as a measure of temporary relief, to puncture with a fine trocar, and aspirate, and withdraw the whole of the fluid. The best place for puncture on the *left* side is just in front of the last intercostal space. But on the *right* side it is advisable, in order to avoid the risk of wounding the liver, to puncture lower down—a spot midway between the last rib and the iliac spine, and about two inches behind the latter, may be selected. The sac, however, is prone to refill, and in that case we should have recourse to nephrotomy, with a view to dealing radically with the cause of obstruction. The development of various forms of plastic operation in renal surgery has made nephrectomy an operation of much greater rarity in cases of hydronephrosis than formerly.

In bilateral hydronephrosis the first thing is to ascertain the cause in the ureter, bladder, or urethra, and if possible to remove or remedy it. If the cause is remediable, the condition cannot safely be left alone, as there will be progressive destruction of the functional kidney substance, and the added danger of purulent infection of both kidneys. We have already indicated the common causes of bilateral hydronephrosis, and the appropriate measures of relief fall within the domain of surgery rather than of medicine.

PYELITIS AND PYURIA (*pus in the urine*)

The occurrence of *pus* in the urine is often the consequence of suppurative pyelitis, set up by irritation of the mucous membrane of the pelvis of the kidney by the presence there of a renal calculus paving the way for infection by septic micro-organisms. This suppurative inflammation may pass downwards along the ureter and reach the bladder. Or the order may be inverted, and suppurative pyelitis may be, and often is, the result of an ascending infection (the introduction of septic organisms) from the bladder (cystitis), or the prostate (prostatitis), or the urethra (gonorrhœa). If suppuration involves both kidney and pelvis, it is termed suppurative pyelo-nephritis.

Tuberculous disease of the kidney usually gives rise to pyelitis with pus in the urine; and pus in the urine may occasionally depend on the rupture of an abscess of adjacent parts into the urinary *passages*.

Slighter forms of pyelitis are occasionally seen in the course of infective fevers, especially typhoid fever, in conditions of ill-health that lower the general resisting power, and occasionally in pregnancy. By far the most common agent of infection is the colon bacillus, but in typhoid fever the typhoid bacillus will be found alone, or as well. But for the pus in the urine, the condition may present no symptoms at all: at most there will be a little pain or tenderness in the affected loin, with frequency of micturition, and some irregular disturbance of temperature. The symptoms nearly always subside quickly with appropriate treatment, but occasionally they pave the way for an obstinate chronic pyelitis.

The following are the common **symptoms** of calculous pyelitis: pain in the region of the kidney, especially on the diseased side; pus, and sometimes blood, in the urine; fever of a hectic or remittent or intermittent type, often accompanied by periodical rigors and attacks of true renal colic; progressive weakness and cachexia. Should any obstruction arise to the free discharge of the pus, it may, as in hydronephrosis, accumulate in the pelvis of the kidney, and cause great distension of this organ and the appearance of an abdominal tumour, "*pyonephrosis.*" Complete blocking of the ureter will lead to disappearance of pus from the urine. Such a condition has been known to terminate favourably, after a certain period, by subsidence of the inflammation, and a shrinking and drying up of the kidney into a putty-like mass. But the prognosis is most unfavourable, and usually induces a profound septicæmia. If left to itself, it is apt to lead on to the formation of a *perinephritic abscess*, dependent generally on ulceration and perforation of the mucous membrane and the escape of pus and urine into the adjacent connective tissue. The perinephritic abscess may point and burst and discharge in the loin, or it may burrow in various directions.

The **treatment** of pyuria must, of course, depend on its causes. When pus in the urine is due to calculous pyelitis it can only be cured by the removal of the cause, viz. the calculus in the kidney, and the same methods already referred to for the promotion of the solution, or removal, of renal calculi may be applied. If the calculus is composed of uric acid, the alkaline treatment already described, together with an exclusively milk diet, or a diet almost exclusively confined to milk and the lightest of foods, or a course of mineral waters at Vichy or Contrexéville, may be attended by satisfactory results. If the calculus should be composed chiefly of oxalate of lime, solution cannot be looked for ; but if it is not of large size, the discharge of such a stone during treatment at Contrexéville is by no means an uncommon event. If a tumour forms in the loins, or should the patient's sufferings be great and medical measures prove unsuccessful, surgical interference is called for without delay.

In the slighter cases of catarrhal pyelitis, such as occur in gouty or rheumatic subjects, warm baths, confinement to bed for a few days, and warm bland alkaline drinks, the avoidance of all possible irritants in the food, of which milk and its preparations are the most suitable, and the administration of saline laxatives and alkalies, will usually remove the symptoms complained of. For relief of lumbar pain warm baths, hot fomentations or a large linseed and mustard poultice, or dry cupping, are all comforting expedients. Sometimes cold applications are preferred. The pain will seldom be severe enough to call for the use of morphia ; a combination of bromides and hyoscyamus will generally suffice.

If the symptoms do not immediately yield, and pus, in small amount, continues to appear in the urine, some benefit may usually be derived from the administration of urinary antiseptics, such as urotropine or helmitol in small repeated doses. The use of balsamic stimulants is also indicated, such as oil of santal wood, copaiba, juniper, turpentine, etc. This last drug, though irritant in large doses, is often very useful in small doses in cases of chronic suppuration of the urinary tract. Wood recommends that it should be given in emulsion, in doses of 10 to 15 minims, mixed with a dram of glycerine and 1 or 2 drops of oil of wintergreen to cover its taste. Sometimes change of air and the administration of tonics, and particularly of quinine, will assist the cure of an indolent pyuria. And if the pyuria is dependent on the colon bacillus, vaccination with this organism may also be tried.

Occasionally pyuria may persist for years without any constitutional symptoms, and without involving the kidney or bladder, but this is very exceptional, and should not encourage us to postpone surgical interference.

In the case of pyuria from tuberculosis of the kidney, early nephrectomy, complete or partial, is the only legitimate treatment, if we can be reasonably sure that the disease is confined to one kidney. Some cases present so few symptoms as to tempt one to hazard by strict hygienic regimen spontaneous arrest of the disease, if no focus for fresh infection can be found elsewhere. The dangers of temporising seem to us greatly to outweigh those of active surgical interference.

Before recommending operation even in benign cases of pyelitis we must try to ascertain the healthy condition of the other kidney. This will necessitate the use of the cystoscope, or even of the ureteric catheter or Luy's segregator. With all these aids we can ascertain no more than that it is functionally active; we can never be sure that the seeds of disease are not already sown.

CYSTITIS

Catarrh of the bladder is met with both in an *acute* and in a *chronic* form. **Acute cystitis** is nearly always due to infection of the bladder with micro-organisms. We must, however, admit its occasional origin in the irritation of certain drugs during excretion—such as turpentine and cantharides—and perhaps from the presence of crystalline deposits from the urine; free indulgence in the heavier wines will at times excite an attack in a susceptible subject. The infective organisms, most often simple putrefactive organisms—the colon bacillus or the gonococcus —commonly reach the bladder by way of the urethra, but they may also be brought in the urine from the kidneys, or find their way directly from the bowel or the vagina. An acute attack is apt to be ushered in by a general febrile disturbance with chills and even rigors; there is pain in the perineum and bladder, accompanied by frequent painful micturition. The, urine is at first acid, and is turbid with mucus and pus and may even contain blood. Later the reaction may become neutral or alkaline, but this depends on the nature of the infecting micro-organisms. In an acute attack, the patient should at once be placed in a warm bed, and a full saline purgative should be administered. From time to time he may be placed in a sitz-bath, in water as hot as he can bear, the temperature being maintained by the addition of hot water from time to time. On returning to bed, hot applications may be continuously applied to the hypogastrium and perineum. If pain demands it, a suppository of morphia or belladonna may be introduced into the bowel, and repeated when necessary. He should be encouraged to drink freely of bland diluent fluids, such as barley water or linseed tea, so as to diminish the irritation of the urine. If the urine is highly acid, he may drink freely of Vichy water or any alkaline carbonated water. Milk is the most suitable food, and may be given with Vichy or Apollinaris water. A combination of citrate of potassium with tincture of hyoscyamus in infusion of buchu, given at frequent intervals, will exercise a soothing effect. If, however, the urine is alkaline, we must depend on simple diluents without alkalis, while benzoic acid, benzoate of ammonium and phosphate of soda, or urotropine, may be administered internally. During the most acute stage, it may be impossible to carry out antiseptic irrigation of the bladder, but as soon as circumstances permit, it should be washed out twice a day. There is a varied choice of solutions for this purpose: saturated solution of boric acid; 5 per cent. carbolic acid; silver nitrate 2 grains to the pint; some prefer normal saline solution; all should be used at body temperature. Whatever solution is employed, it should be used copiously, each irrigation being continued until the returning fluid is absolutely clear. Under strict treatment of this kind the trouble will usually subside in a week or little more.

Chronic cystitis is occasionally a remainder of acute cystitis, but in a great majority of cases arises from the introduction of infecting micro-organisms into a bladder of which the functions are already disturbed by the existence of some abnormal condition, such as prostatic enlargement, urethral stricture, vesical calculus, or paralysis; or, again, the infection may be a descending infection from the kidney in cases of renal pyuria.

The symptoms are much less marked than in acute cystitis; indeed, there may be no more than troublesome frequency of micturition, while the urine is turbid with mucus and pus. The colon bacillus is the most frequent infective agent, so that the urine is commonly acid. With staphylococcic infection the urine is generally feebly acid or neutral, while the proteus bacillus is apt to render the urine alkaline. In the course of chronic cystitis, periodic attacks of subacute symptoms are apt to occur, if from insufficient care fresh infection is introduced into the bladder. A not infrequent cause is the neglect to bestow the same care on cleansing the opening of the urethra and its surroundings as is devoted to the cleansing of the catheter. Treatment consists in the first place in removing any cause we may find; thus a stricture may need dilatation, an enlarged prostate may call for removal, or a vesical calculus. If no such cause can be found, the bladder should be irrigated night and morning with one of the antiseptic solutions we have named. In chronic cases perhaps a silver nitrate solution is the best, and its strength may be gradually increased. Drugs will be administered internally on the same lines as in acute cystitis, and there is benefit to be derived from keeping the urine dilute. The same restrictions of diet will not be needed as in acute cystitis, but alcoholic drinks should be entirely prohibited. If, in spite of patient and thorough treatment, the symptoms persist or show a tendency to repeated recurrence, and a pure culture of the colon bacillus has been found in the urine, we may consider the propriety of supplementing our resources by vaccination with that organism. Many successful results have been already recorded.

ADDITIONAL FORMULÆ

For cystitis

℞ Terebinthinæ puræ } āā
Extracti gentianæ } gr. xlv.

M. et. div. in. pil. xxx. A pill three times a day, followed by two tablespoonfuls of lime water in milk.

(*Prof. Neumann.*)

Also

℞ Acidi benzoici, gr. lxxv.
Syrupi aurantii, ʒv.
Aquæ destillatæ ad ℥x.

M. f. mist. A tablespoonful every two hours. (*Neumann.*)

In chronic cystitis

℞ Foliorum buchu, ʒij.
Foliorum uvæ ursi, ʒij.
Aquæ ferventis, ℥vj.
Macerate for two hours, strain, and add
Liquoris potassæ, ʒj.
Tincturæ cinnamomi, ʒiij.
Tincturæ hyoscyami, ʒiij.

M. f. mist. Two tablespoonfuls three times a day. (*Druitt.*)

For cystitis

℞ Sodii bicarbonatis, gr. lxxv.
Decocti uvæ ursi, ℥vj.

M. f. mist. A tablespoonful every two hours.

(*Prof. Albert, Vienna.*)

For gonorrheal cystitis

℞ Ol. santal. flav. purissimi (recentis) } ♏xv.
Pulv. acaciæ recentis }
Potassii bicarbonatis, āā gr. xxx.
Salol, gr. v.
Essent. menthæ pip., ♏iij.
Aquæ, ad ℥j.

Fiat emulsio. To be taken every four hours until evidence of its excretion by the urine is strongly marked by its characteristic scent, when the administration should be reduced in frequency. (*Pardoe.*)

For washing out the bladder

℞ Aluminis
Zinci sulphatis } āā ℥ss.
Acidi carbolici
Aquæ destillatæ, ad ℥x.

M. f. lotio. To be mixed with ten times as much water, and about a pint of the mixture to be injected daily into the bladder. (*Albert.*)

Powders for acute cystitis

℞ Lupulini, gr. xv.
Morphinæ hydrochlor., gr. ¾.
Sacchari albi, gr. xlv.

M. et divide in pulv. viij. Three to five daily.
(*Prof. Ultzmann.*)

For washing out the bladder in chronic cystitis

℞ Acidi borici, ℥ss.
Glycerini, ℥j.
Aquæ destillatæ ad ℥v.

M. f. lotio. To be mixed with an equal quantity of warm water. (*Ultzmann.*)

For the same

℞ Tinct. iodi
Potassii iodidi } āā pt. i.
Ext: belladonnæ
Aquæ ad. pt. 300.

If the catarrh is putrid and offensive

℞ Resorcini, gr. xlv ad lxx.
Aquæ destillatæ, ℥iij.
M. f. lotio. (*Ultzmann.*)

For the solution of phosphatic deposits in the bladder

℞ Acidi hydrochlorici fortioris, ♏iij.
Aquæ destillatæ, ℥vj.
M. f. lotio. (*Ultzmann.*)

For calculous pyelitis (uric acid or oxalate of lime)

℞ Sodii phosphatis, ℥j.
Sodii bicarbonatis, ℥ij.
Lithii carbonatis, ʒijss.

M. f. pulv. A teaspoonful in a pint of water three times a day. (*Ultzmann.*)

The use of glycerine in the treatment of uric acid calculi

Several German physicians (Rosenfeld, Casper, Kugler, and Hermann of Carlsbad) have reported excellent results in cases of nephrolithiasis by the administration of large doses of glycerine by the mouth, the good effects being due, it is believed, to physical changes it produces in the urine. The dose given is 1 to 4 oz. dissolved in an equal quantity of water, and taken between two meals every two or three days for a period of several days. In these doses it is said to cause the urine to become somewhat oily in consistence, and the good results are attributed to its lubricating action. Another suggested explanation is that by raising the specific gravity of the urine it produces a change in the position of the calculi in the pelvis of the kidney. In 62 per cent. of cases in which it was given it either removed the concretions or relieved the pain associated with the disease.

CHAPTER III

TREATMENT OF INFLAMMATORY DISEASES OF THE KIDNEYS — ACUTE AND CHRONIC BRIGHT'S DISEASE

Acute Bright's Disease, Acute Nephritis.—Causes—Nature—Symptoms—Changes in the Urine—Increased Arterial Tension—Effusions into Serous Cavities—Uræmia—*Indications for Treatment*—Advantages of Milk Diet—Accessory Foods—Dilute Alkaline Drinks—Local Measures—Stimulation of the Skin by Hot Baths, or Hot-Air or Vapour Baths, or the Wet Pack—Diaphoretics—Pilocarpine—Purgatives—Diuretics — Nitro-glycerine—Caffeine—Theobromine—Treatment of certain Symptoms—Of Vomiting, of Dropsy, of Uræmia, of Cardiac Debility and Anæmia—Treatment of Convalescence.

Chronic Bright's Disease. — (*a*) *Chronic Parenchymatous Nephritis*—Origin—Symptoms—Characters of Urine—Arterial and Cardiac Changes—*Indications for Treatment*—Milk Diet—Vegetable Foods—Avoidance of Animal Extracts—Alcohol — Drug Treatment not of great value — Diuretics — Mild Alkaline Waters — Digitalis — Caffeine — Acupuncture for Anasarca — Saline Aperients — Nitro-glycerine — Lumbar Puncture Hygienic and Climatic Treatment. (*b*) *Chronic Interstitial Nephritis*—Causes—Insidious Onset—Early Symptoms—Characters of the Urine—High Arterial Tension and Cardiac Hypertrophy—Frequency of intercurrent Affections—*Indications for Treatment*—Regiminal—Dietetic—Climatic—Medicinal.

Additional Formulæ.

Acute Bright's Disease—Acute Nephritis

An acute inflammation of the kidneys may be determined by exposure to cold, by the effect of chill on the surface of the body, between which and the kidneys a very close relationship seems to exist. Exposure to cold, especially after severe muscular exertion, which makes a great call on the excretory functions of the kidneys, is a frequent cause of acute nephritis. It may also be caused by the action of toxic agents on those organs, as the toxines produced by the microbes of the specific infective fevers, and especially that of scarlet fever. Syphilis is a more common cause of acute or subacute nephritis than is commonly recognised, the condition arising, like syphilitic myelitis, within a year or two of infection.

Alcoholic excesses, irritant drugs, such as turpentine, cantharides, carbolic acid, and potassic chlorate, may excite an acute congestion of the kidneys, which may run on to inflammation. It sometimes occurs in connection with pregnancy, but the precise manner in which this arises is not at present known.

The two most common causes of *acute* nephritis in England are exposure to cold and scarlet fever.

The epithelium, the blood-vessels, and the intertubular connective tissue are affected in varying degrees of intensity in different forms of this affection, so that different writers describe (*a*) a *tubular*, the common form, (*b*) a *glomerular*, the scarlatinal form, and (*c*) an acute *interstitial* nephritis. These different forms cannot be recognised clinically, and it is in the clinical aspects of disease that we are at present mainly interested.

It is difficult to say what may be the precise physical changes in the kidneys at the onset of an attack of acute nephritis, since anatomical investigations can only disclose the *post-mortem* appearances; but we may conclude that there is more or less intense hyperæmia with inflammatory exudation, containing leucocytes and red blood corpuscles, affecting especially the capillaries and the epithelium of the glomeruli. These alterations interfere with the circulation in the Malpighian tufts, and seriously disturb the nutrition of the secreting tubules. Accumulations of inflammatory products—altered cells, leucocytes, and blood corpuscles—in the convoluted tubules cause the whole organ to become enlarged and sometimes greatly swollen. The tubules are thus blocked, the vascular tufts compressed, and excretion gravely interfered with and sometimes even arrested. More or less, also, of inflammatory exudation takes place in the connective tissue between the tubules, and thus the intertubal capillary plexus is also compressed.

What are the **symptoms** attending this affection? Acute nephritis may arise insidiously and be discovered only on examination of the urine. Sometimes the onset is marked by chills and rigor, together with some lumbar pain, nausea and vomiting. Headache, constipation, and a furred tongue are usually present. The temperature is not always raised, and when it is rarely exceeds 103°, and may range between that and 100°. Cases of acute nephritis are sharply divided into those accompanied by dropsy and those without it; speaking generally, the former are the more serious. But it is naturally to changes in the **urine** that we look for conclusive evidence of the presence of acute nephritis. The urine is usually found to be scanty (in a few cases it may be entirely suppressed), high-coloured or "*smoky*," of high specific gravity (1025 to 1030), and to contain albumen, blood corpuscles, and casts of the renal tubules, epithelial, hyaline, and blood casts. Sometimes it is of a dark red colour, from the presence of a considerable amount of blood. The excretion of urea is diminished, although the percentage in the urine passed may be high.

Pallor and puffiness of the face with œdema of the ankles may develop, or diffuse anasarca with a marked anæmic aspect of the surface, and dropsical effusions into the serous cavities. In the gravest cases œdema of the lungs, larynx, and brain may arise. The skin is dry and the pulse hard, from *increased vascular tension*, and the second sound over the aorta is accentuated.

Symptoms of acute uræmia appear in some cases. It is, however, on the examination of the urine that the diagnosis mainly depends, as cases of acute nephritis may occur without anasarca.

In the nephritis of pregnancy, the first indication of its existence may be a uræmic convulsion.

A brief duration and rapid recovery occasionally attend cases referable to chill, but cases following scarlet fever, however favourable their course, are rarely convalescent in less than a month. In such cases the dropsy, after eight or ten days, subsides, the urine increases in amount, and the albumen lessens. There is, however, a great tendency in these cases to become *chronic*. The most serious results in these acute cases are the occurrence of considerable effusions into the serous cavities and the onset of uræmia.

The **indications for treatment** are tolerably clear; they are:—

(1) To allay all irritation of the inflamed organs by securing to them, as far as possible, functional rest, *i.e.* by avoiding the ingestion of substances that yield end-products difficult of excretion by the kidney, and promoting their excretion by other channels (skin and bowel); (2) so far as practicable, to keep the obstructed tubules free of inflammatory exudations; (3) to moderate the increased arterial tension; (4) to diminish the renal hyperæmia by counter-irritation and derivation to the surface; and (5) to treat promptly serious symptoms as they arise, such as large effusions into the serous cavities, or the symptoms due to retention of renal excrementitious matters in the blood.

It has been said that threatened attacks of acute nephritis in scarlet fever, the evidences of which were the presence of blood colouring matter in the urine and increase of arterial tension, have been warded off by a smart saline purge. Some physicians make a routine practice in every case of scarlet fever of encouraging the patient to take water abundantly, so as to dilute the toxines excreted by the kidney. It is claimed that the frequency and severity of scarlatinal nephritis is greatly diminished thereby.

In severe cases, with fever, pain in the back, and general dropsy, the following method of treatment should be adopted:—

The patient should be confined to bed in a room the temperature of which is less than

65° F., and as the proposed treatment will be directed to producing free action of the skin, he should lie between blankets and wear a thin flannel bed-gown, with long sleeves to the wrists, to avoid all risks of chill.

His diet should consist exclusively of milk and water; pure milk is often difficult of digestion, but it is less likely to be so if diluted with an equal quantity of hot water or with hot thin oatmeal gruel. Buttermilk, if it should be preferred, may be taken instead of milk, and barley water may also be freely partaken of; a little thin arrowroot is also permissible. If the patient does not object, it is desirable that these drinks should be warm. In cases of marked gastric disturbance it may even be necessary to pancreatise the milk.

The advantage of **milk** as a food is that it supplies sufficient albumen to compensate for the loss by the kidneys, as well as the other substances needed for complete nutrition, while it contains a very small amount of waste material for elimination. It is also a non-irritating diuretic.

The milk should be drunk in small mouthfuls at a time, and not in large draughts. If drunk in the latter fashion, a sense of weight at the stomach is sometimes complained of.

From 4 to 6 pints of fluid in the 24 hours, including the milk, will usually be sufficient for an adult: 3 pints of milk in 24 hours is the smallest amount that will serve to maintain nutritive equilibrium in an average adult for a week or two.

Von Noorden prefers a mixture of $\frac{1}{4}$ pint of cream to 1 pint of milk. The advantages of this mixture are that the patient gets a larger amount of nutrition with relatively less proteid and less fluid: this latter may be a very important matter in the face of suppression of urine or rapidly extending dropsy. One pint and a quarter of this mixture may suffice for 4 or 5 days, if thirst be relieved by sucking small pieces of ice, or otherwise. If for any reason a wider range of selection in the diet is demanded, it should be in the direction of carbohydrate and fatty foods; milk arrowroot, a milky rice or tapioca pudding, or a slice of well-buttered white bread may be given in addition to the milk.

So long as dropsy be absent, and urinary water free, and there are no special contra-indications in the state of the general circulation, the free use of fluids is desirable in order to keep the kidneys flushed—to wash out the *débris* from the renal tubules, and to promote the elimination of salts and nitrogenous waste products that may have accumulated in the tissues. Water, therefore, may then be drunk freely, and there is no reason why it should not be freely mixed with the milk that is taken as food, especially as it promotes its digestibility, and this will be particularly the case if some alkali be added to the water; for this purpose the milk may be diluted with Vichy water, or a few grains of bicarbonate of soda may be added to each cup of milk and water. We agree with Sir William Roberts that it is beneficial to give some alkali in this way, in order to lessen the acidity of the urine, and so diminish its irritating effect on the kidneys, while at the same time alkaline fluids promote the clearing of the renal tubules of inflammatory products.

Other drinks which may be permitted are weak lemonade (home-made without sugar), imperial drink (made by adding 1 dram of cream of tartar and the juice of half a lemon to a pint of hot water, and allowing to cool), and whey, which may be readily made by boiling milk with a little lemon-juice or with cream of tartar, two tablespoonfuls to the pint, and straining. This may be taken freely; it is pleasant and slightly nutritious, and very useful for patients who do not like, or cannot digest, milk.

Local measures to relieve the engorgement of the kidneys often prove most serviceable; and when there is much blood in the urine, and complaint of pains in the back, they should never be overlooked. They often check threatened suppression of urine. In robust persons, 12 to 20 leeches, or a few cupping glasses, may be applied over the region of the kidneys, followed by a hot linseed poultice, which should be quickly renewed and never allowed to get cold. It too often happens that such poultices are very carelessly applied, and, to avoid this risk, it may sometimes be better, when we are not sure of our nurse, to trust to a layer of hot cotton-wool. When it seems undesirable to withdraw any blood, we may employ dry cupping. The object of dry cupping is to withdraw to the surface of the body blood that would otherwise pass to the kidneys, and also to accelerate its movement in its altered route. For this reason a cup should be removed as soon as decided redness appears and be reapplied to another spot. If allowed to remain too long, the tendency is to produce a temporary local stagnation of blood in the capillaries. Repeated hot mustard poultices are, perhaps, as efficacious as anything, and they are easy to apply. Some physicians prefer the use of Paquelin's thermocautery. Edebohl's operation of renal decapsulation for relief of tension has, in our opinion, no place in the field of practical therapeutics.

In order to relieve the kidney of its eliminative functions, we make vigorous calls upon the excreting functions of the skin and intestinal mucous membrane, and, in doing this, we also favour the removal of renal congestion by diverting the blood more especially to the cutaneous and intestinal surfaces. We thus also do our best to avoid the accumulation in the blood of retained urinary excreta, and we moderate vascular tension. When there is dropsy, we also, in this way, get rid of much of the dropsical fluid.

To stimulate the skin to increased activity, we may, in the first place, employ **hot baths**, or hot-air or vapour baths, or the wet pack ; but in applying either of these measures to promote the action of the skin, the patient, in the absence of extensive dropsy, should be plied with diluent drinks, of which pure water is the best, so that the blood may not be unduly concentrated by loss of water from the surface. Liebermeister advocated the use of the hot bath in the following manner: The patient is placed in the bath at about 100° F., and more hot water is added gradually until the temperature reaches 104° to 106°; he is allowed to remain in the bath from 30 to 60 minutes, then wrapped up in a warm sheet and warm blankets for two or three hours. A profuse perspiration may usually be induced by this means. The difficulty about the bath is that it is not always easy to bring the bath to the patient's bedside; and there may be risk of chill in conveying the patient to another apartment for the purpose.

The **wet pack** may be employed as a substitute for the hot bath. The patient is wrapped round with a sheet dipped in hot water, and then covered up with hot blankets. Whitla describes the method he adopts as consisting in dipping a large, thick, double blanket into nearly boiling water, with which a few ounces of mustard have been mixed; this is left in for a few minutes, and then well wrung out by attendants, and the patient is carefully wrapped in it, all the body except the face and head. There is no danger of having the blanket too hot; the difficulty is in keeping it hot enough, owing to rapid evaporation from the large surface. The patient is then placed on a straw mattress, and covered with blankets for two hours, when profuse perspiration occurs. He is now rubbed dry, and placed between warm blankets. When in the pack he is given warm barley water, or whey. A very convenient appliance for acting on the skin is the hot-air bath (Fig. 20). It is readily extemporised. A spirit lamp is placed on the floor near the bed, with it a tin funnel is connected, furnished with a tube bent at a right angle, and of a suitable length to pass under the bed-clothes at the foot of the bed. The bed-clothes are tucked closely round the patient's neck.

The heat given off by the lamp, and the steam formed by the combustion of the spirit, usually suffice to throw the patient into a profuse perspiration. A bath of this kind may be frequently repeated, but as a rule it is not desirable to allow them more often than on alternate days. The electric light bath may be used, when available, provided only a moderate temperature, not exceeding 150°, is employed. In strong subjects free sweating should be promoted by a preliminary injection of *pilocarpine*: in weaker subjects, who are liable to feel faint and exhausted by the hot-air bath, this may be forestalled and diaphoresis aided by a glass of hot grog—perhaps gin and water is best. Or a dram of sal volatile may be given, freely diluted with hot water; or we may use some stimulating diaphoretic mixture, such as $\frac{1}{2}$ a dram of sal volatile, $\frac{1}{2}$ a dram of spirit of nitrous ether, and 2 or 3 drams of solution of ammonium acetate, mixed with one ounce and a half of camphor water. Such a dose may be given three or four times a day. If the body temperature is high, and the pulse tension great, and it is the *commencement* of the attack, 2 or 3 minims of tincture of aconite may be added to each dose, but this drug must not be continued for more than four or five doses, on account

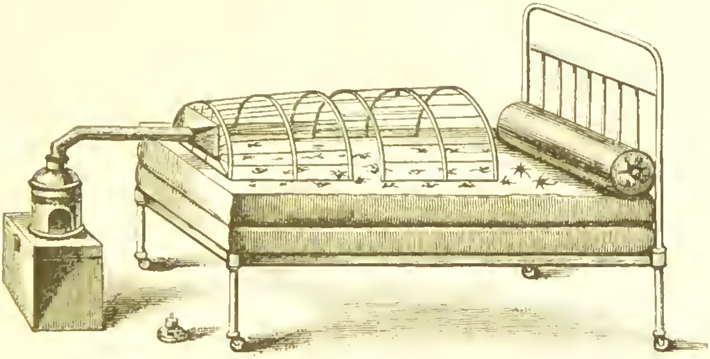

Fig. 20.—Hot-air Bath.

of its depressing effect on the heart; and, when it does good, the good it does is usually immediate. Its beneficial effects are much more marked in the case of children than of adults.

Objection has been made to the use of pilocarpine on account of some unpleasant symptoms that have been observed to follow its employment, such as nausea, vomiting, and even collapse. It is also liable to produce an unpleasant, cold, clammy perspiration, unless used merely as an auxiliary to the hot-air bath or hot wet pack. Great care and discrimination should be shown in the cases in which it is administered; and if notable cardiac weakness is known to exist it should be withheld. Pilocarpine excites free secretion in the bronchioles, and can only make matters worse, when there is already any marked degree of œdema of the lungs or moist catarrh. The dose of pilocarpine should be small at first, say one-fifth of a grain of nitrate of pilocarpine, or, if preferred, one-tenth of a grain, to be repeated in fifteen minutes; with each injection the patient may be given a few mouthfuls of hot coffee.

We do not think it is a suitable drug for children, as they vary so very greatly in their capacity for tolerating certain medicines.

Free purgation is another measure adopted for the purpose of relieving the kidneys of their eliminating functions, and of removing from the blood some of the solid and toxic constituents of the urinary excretion, and so reducing vascular tension, while it also helps to carry off dropsical effusions.

If a saline purgative is used it should be given in concentrated solution, when its action will be almost wholly confined to the bowels, and will give rise to no irritation of the kidneys.

The compound jalap powder is the favourite purge in England for cases like these; from 30 to 60 grains, in a little water, may be given once or twice daily; or 2 or 3 drams of magnesium or sodium sulphate, dissolved in an ounce or two of water, may be given every morning fasting. It is rarely necessary or desirable to have recourse to the more violent purgatives, such as croton oil, camboge, or elaterium. In milder cases it is only necessary to give aperients to keep the bowels regularly relieved, and in children, for this purpose, an ounce or two of fluid magnesia with a teaspoonful of lemon-juice, early in the morning, is both pleasant and efficacious; or a few grains of compound scammony powder may be given each night.

It is important that the patient should not be exposed to any risk of chill during the action of the bowels. He must not therefore be allowed to get up and leave his warm room for this purpose.

Some differences of opinion have existed as to the propriety of giving **diuretics** in cases of acute nephritis. The stimulating diuretics, which act on the secreting cells of the kidneys, are certainly, in our opinion, counter-indicated, but this is not the case with those diuretics which simply favour the flow of water through the kidneys; we have already pointed out that, in the absence of any special contra-indications, such flushings of the renal tubules are advantageous. Of such diuretics *water* is the best; and we may usefully add to the water small quantities of alkaline salts—the potassium citrate or the sodium benzoate, and sodium bicarbonate; the two former are believed to have the property of favouring "the conversion of the urates into less irritating and more easily excreted compounds."

The use of diuretics which act by raising the arterial tension, such as digitalis or strophanthus, must be approached with caution; they are certainly not suitable in the early stages, but are of value when the arterial tension is low, the urine scanty, and the heart's impulse feeble. They may be employed when the stage of active engorgement of the kidneys is passed, and when the cardiac force may require raising; they then often exercise a beneficial diuretic effect. It has been suggested that in the hyperæmic stage the administration of *nitro-glycerine* or *sodium nitrite* may, by lessening the general arterial pressure, relieve the strain upon the weakened renal vessels and give them the opportunity to recover their tone.

Caffeine, which, like digitalis, raises arterial tension and so increases the flow of urine, may be substituted for it. The best mode of giving it is as a hypodermic injection in solution in sodium benzoate; from 3 to 10 grains of caffeine with the same quantity of sodium benzoate may be dissolved in a few minims of warm distilled water and used for each injection. Or it may be given by the mouth.

Theobromine is regarded by many as a better diuretic than caffeine because it does not produce the initial vaso-constriction of caffeine: 20 to 30 grains may be given in 5-grain doses, in cachet, spread over the 24 hours. If a soluble preparation of theobromine is preferred, agurin (theobromine-sodio-sodic acetate) may be given in divided doses up to 40 grains daily in aqueous solution.

The advocates of *organotherapy* have reported benefit as arising from the administration of some half-cooked kidney in the patient's food, with the idea that it supplies an internal secretion, but we doubt the accuracy both of the theory and of the practice.

An efficient diuretic may often be found in a combination of potassium acetate (30 grains), infusion of digitalis (2 to 4 drams), and decoction of broom tops (1 to 2 ounces). This dose may be given every four to six hours. Potassium iodide proves a most efficient diuretic in some cases, and it does not appear to produce any irritant effect on the kidneys, while it has a decidedly beneficial influence on the cardiovascular changes, and in syphilitic cases may actually lead to complete cure. In cases tending to chronicity and accompanied with anæmia it may be combined advantageously with the syrup of the iodide of iron. Complete suppression of urine in acute cases should be met by the withdrawal of all food by the mouth and even water, thirst being relieved by sucking small pieces of ice. A succession of hot poultices should be applied over the kidneys, while saline solution is freely introduced into the subcutaneous tissues. Nitro-glycerine may be given to relax the renal artery.

The **symptoms** which may require special consideration in connection with the treatment of a case of acute nephritis are the following: (*a*) nausea and vomiting, (*b*) an extreme amount of general dropsy with effusion into the serous cavities, (*c*) uræmia with convulsions, (*d*) anæmia and cardiac dilatation.

Vomiting may be to a certain extent useful in eliminating toxic substances from the blood, and should not be immediately checked; but when it is continued and exhausting we must endeavour to arrest it. For this purpose small fragments of ice may be sucked, or a mixture containing the ammonio-citrate of bismuth and dilute hydrocyanic acid may be given—a mustard plaster may be applied to the epigastrium, drop doses of creasote mixed with a little lime water may be given, or drop doses of tincture of iodine in water. The patient may, at the same time, be fed by nutrient enemata—peptonised milk being suitable for this purpose; should there be any difficulty in retaining this, 2 or 3 minims of tincture of opium (in *adults*) may be added to each enema.

In obstinate cases of *dropsical effusion* some benefit may be derived from diminution of common salt in the food. If the kidney excretes salt with difficulty—and this may be determined by periodic examination of the urine—it accumulates in the tissues and attracts fluid from the vessels. By reducing the intake of salt below the output a point is reached at which the tissues no longer hold back the fluid; it is reabsorbed and then excreted by the kidney. It is sufficient as a rule to forbid the taking of salt with food and to prohibit its use in the preparation. The procedure, in our experience, has but a limited field of usefulness.

An *extreme amount of dropsy*, which does not yield to the measures we have already indicated, must be relieved by draining away the fluid by *puncture* of the skin of the legs; we have described how this may be best carried out when dealing with the treatment of cardiac dropsy.

Effusion into the pleural cavities, if it give rise, by its amount, to serious dyspnœa, must be removed by puncture and drainage. A large accumulation of ascitic fluid may require to be removed by paracentesis.

Uræmic symptoms—headache, drowsiness, convulsions—must be immediately encountered by appropriate measures. It is stated that the drowsiness of impending uræmia may often be warded off by full doses of benzoate of soda. In acute forms of uræmia in the robust, the most striking relief to the symptoms is often afforded by the abstraction of 10 to 20 ounces of blood from the arm. This is, however, a measure which is perforce reserved for exceptional cases, such as persistent and severe convulsions, excessively high arterial tension, and *post-partum* cases. The value of this measure may be further enhanced by washing out the blood with a pint or more of warm hypotonic saline solution, introduced either into a vein or into the lax subcutaneous tissues. Leeches to the temples, or ice-bags applied to the nape of the neck, may suffice to relieve the uræmic headache. Chloroform inhalations or inhalations of amyl nitrite may be useful to allay violent convulsions, and the effect may be maintained by introducing into the rectum a dram of chloral hydrate dissolved in 4 ounces of water. Lumbar puncture, in cases with high arterial tension, has at times checked the convulsions immediately. When venesection is not practised, derivation to the skin and profuse perspiration should be induced by the hypodermic injection of pilocarpine, and the bowels should be freely acted upon by a brisk purgative. A dose of elaterium or croton oil may in such cases be given, as there might be some difficulty in getting the patient to swallow a draught of any kind, whereas a dose of compound powder of elaterine ($\frac{1}{2}$ to 3 grains), or a drop of croton oil mixed with a few grains of sugar, may be thrown on the tongue and washed down with a teaspoonful or two of water. In children dry cupping to the loins may be desirable, the wet pack applied, as well as a brisk purge given. There is considerable difference of opinion as to the propriety of using morphia to prevent the recurrence of uræmic convulsions. It will be safest to avoid its use when we can gain this end by inhalation of chloroform, aided by the rectal injection of chloral hydrate, but this is not always the case. Then we must use morphia as the less of two evils. Loomis recommends it only in uræmia from acute parenchymatous nephritis. But there is often great difficulty in determining the precise condition of the kidney in any given case. In spite of brilliant results in some cases, it must be admitted that in at least a few the use of morphia has distinctly precipitated a fatal issue. Recently urethane in full doses of 30 grains, dissolved in an ounce of chloroform water, and repeated every few hours for several doses, has met with some favour as a sedative in acute uræmia.

It has been said that to excite profuse perspiration in these uræmic attacks must be injurious, by causing a concentration of the blood, unless we can at the same time ensure the free absorption of water by the stomach, or by the injection of warm water into the rectum. The best answer, however, to this objection is the frequently observed fact that patients come out of the uræmic state when, under the influence of *pilocarpine* or the wet pack, free action of the skin has been established. Much depends on the ability of the skin to take upon itself the eliminating functions of the kidneys, which, on experimental, not clinical, grounds has been doubted. If it should only allow of aqueous transpiration, then excessive perspiration might lead to a dangerous concentration of toxic substances in the blood, but when it is capable of freely eliminating the solid and toxic constituents of the urine, and we know this to be the case, then its excessive action must be beneficial, as in the great majority of instances it is practically found to be.

Again, when fluids cannot be administered by the mouth, we may, if necessary, compensate for the loss of fluid attendant on copious bleeding or free perspiration in uræmic cases by the *subcutaneous injection of dilute saline solutions*, or, as we have said, by rectal injections.

A combination of chloral and bromide of potassium may be sometimes useful in allaying nervous irritation. Jaccoud, and also Carter, believe that the danger of uræmic intoxication may be diminished by the inhalation of oxygen, about 10 litres three times a day. This conclusion is founded on the observation by Jaccoud, that sojourn in compressed air lessened by one-half the toxicity of the urine.

Cardiac dilatation and anæmia may call for cardiac tonics, such as digitalis, caffeine, etc., and if attended by pulmonary œdema, ether, strychnine, and even oxygen inhalations may be needed, as well as dry cupping and counter-irritation to the chest. The *anæmia* will usually extend into the period of **convalescence**, which needs to be very carefully watched in order that the risk of relapse may be avoided.

During this period the patient should be kept at rest, and only the gentlest exercise allowed, as it is known that posture and exercise have an important influence on the excretion of albumen during convalescence from acute nephritis. He should be guarded from all possible chill and be extremely warmly clothed—flannel garments being worn next the skin. Great attention must be paid to the food, which should for a long time be restricted to milk and light farinaceous puddings. No stimulants beyond a little tea or coffee should be permitted, and only small amounts of animal food until the urine is free from albumen. Fresh vegetables, watercress, lettuce, and ripe and cooked fruits may be permitted.

An iron tonic will often prove of great service, as a teaspoonful of the syrup of the phosphate or iodide of iron after food, twice or three times a day. Some patients bear full doses of the tincture of the perchloride well; for others, who are prone to headaches, a combination of the ammonia-citrate (5 to 10 grains) with sodium bromide (5 to 10 grains) thrice daily answers better. It is often most advantageous to the patient to avoid the cold of an English winter after an attack of this kind, and to seek a warm winter health resort, where he can pass some hours daily in the open air without risk of chill. Madeira, the Canaries, the Azores, or one of the resorts in the West Indies, such as Nassau in the Bahamas, are the most suitable for these renal convalescents; but those places are too distant for most invalids, and a sheltered resort on our own South Coast will be more practicable for the majority.

Chronic Bright's Disease

In considering the treatment of chronic Bright's disease, we must recognise two principal divisions: (*a*) *chronic parenchymatous nephritis*, in which the changes in the tubal epithelium preponderate over the changes in the glomeruli and interstitial tissue; and (*b*) *chronic interstitial nephritis*, in which the most marked changes are found in the interstitial tissue of the kidney, and give it the familiar "granular" appearance. It is usual to consider the lardaceous or amyloid kidney as a form of Bright's disease, but as this affection admits of no special treatment, apart from the morbid states of which it is a consequence, we shall not treat of it here.

(*a*) *Chronic Parenchymatous* (*Tubal*) *Nephritis*

This form of chronic Bright's disease either follows an acute attack or comes on slowly and insidiously.

It is usually characterised by a great tendency to anasarca, and it is designated, from an anatomical point of view, the *large white kidney.* In accepting this time-honoured designation, it must not be forgotten that chronic tubal nephritis is often characterised by the existence of a "small white kidney." Some foreign physicians regard malaria as a common cause of this form of Bright's disease. Intemperate habits are also believed to be concerned in its causation in many cases. It is a frequent sequel of scarlatinal nephritis. Chronic septic absorption from any source, and in connection with such diseases as pulmonary tuberculosis, often paves the way for this type of chronic Bright's disease.

When this disease comes on insidiously, the earliest symptoms may be those of gastric dyspepsia, together with progressive debility and anæmia. In a typical case the face becomes pale, and there is puffiness under the eyelids, especially marked on rising in the morning, and in the evening the ankles and feet are puffy and swollen. If the **urine** is examined it is found to be scanty in quantity, pale in colour and often slightly turbid from mucus: in the hæmorrhagic variety it may be smoky from presence of blood. The deposit it throws down on standing usually displays, on microscopic examination, the presence of tube-casts, both large and small, hyaline, epithelial, granular, and fatty; red blood corpuscles, leucocytes, and renal epithelium. There is usually an abundant deposit of albumen with heat and nitric acid. Its density in the early stages may be as high as 1020 to 1025, but as the disease advances the density of the urine becomes lower. There is always a reduction in the amount of urea. The presence of general anasarca, which is very obstinate, is a marked symptom of this form, and the dropsy may affect the serous cavities. Uræmic symptoms not infrequently occur. Arterial changes are common; the pulse tension is variable, being as often unduly low as unduly high, but the vascular walls tend to become thickened and sclerosed; the aortic second sound is accentuated, and the heart though hypertrophied is usually dilated as well. Retinitis frequently occurs. Symptoms of gastro-intestinal irritation, such as vomiting and diarrhœa, are often observed. In very chronic cases it may be difficult to distinguish clinically this from the next form.

The main **indications for treatment** are identical with those in acute nephritis, except that we have no longer to deal with an acute renal hyperæmia. All that has just been said as to the applicability of diaphoretics, purgatives, and diuretics to the treatment of acute nephritis will apply with almost equal force to these chronic forms, the main objects of treatment being to keep the blood as free as possible from contamination by toxic substances no longer eliminated adequately by the kidneys, and to remove dropsical accumulations. A much less degree of stringency, however, in the application of these principles is permissible in a disease of which the duration is measured in months and years, instead of in days. Over and above this we must not neglect the anæmia and general debility, which, while sufficient evils in themselves, must also impair the nutrition of the kidney.

Many remedies have been suggested with the *direct* object of checking the loss of albumen in the urine, but for this purpose all the most capable authorities have been compelled to admit that we have no drug of any great value. Nor can we believe that the daily loss of a few grammes at most of albumen in the urine is a matter of vital importance, representing as it does so small a fraction of the intake of proteid, even on a restricted diet.

The temporary disappearance of albumen from the urine has, however, been noted under the influence of inhalations of oxygen, but after a few weeks of amelioration the albumen in the urine reappears, and the disease follows its usual course. It has been maintained that the most successful method of treatment of these cases hitherto adopted is the restriction of the patient to an almost **absolute milk diet.**

In cases of early tubal nephritis, in which the damage to the kidney is not yet irreparable, we would certainly give the diet a trial, but only under close observation and for a short time. In the desire to spare the kidney we must not come near to starving the body, and we are of opinion that not a little of the general and cardiac weakness encountered in chronic nephritis is brought about by a too exclusive allegiance to milk diet, and too rigid exclusion of stimulant proteids from the food.

In the application of this or of any other method, it is, of course, scarcely necessary to say that it would be fallacious to regard the mere fact of a diminution in the amount of albumen passed in the urine as indicative of a curative effect, unless accompanied also by an improvement in the nutrition, strength, and general condition of the patient.

The advantages of milk as a food for the subjects of chronic renal disease are obvious. Although, theoretically, it contains an excess of albuminates in proportion to fats and carbohydrates, this could readily be rectified, if it were desirable, by the addition of more cream and lactose, and dilution with water. But, in actual practice, it is often found that skimmed milk, in which this disproportion is, of course, much greater, agrees better with the patient than milk which has its full proportion of cream. The great recommendation of milk in these cases is that it possesses so little of refuse substances; all, or nearly all, its nitrogenous constituents can be absorbed and utilised; it contains an easily digested form of fat; its lactose is diuretic; and none of its principles appears capable of causing any irritation of the renal epithelium; so that not only does it not introduce into the blood any, more or less toxic, refuse materials, but it contributes to the elimination of those formed in the body. We would add that we consider its digestibility greatly increased for many patients by dilution with one-third hot water, and the addition of sodium chloride in the proportion of 20 grains to the pint. An adult male, if doing a moderate amount of work or taking gentle exercise, will require, on an exclusively milk diet, some 3 quarts per diem, and this is best given in amounts of 6–8 ounces every two or three hours; if confined to bed, 3 to 5 pints will be sufficient. As a variation in the monotony of milk diet, a hot *milk soup* is very useful, which may be flavoured with a little celery salt; or some shredded Spanish onion, well boiled, may be added to it. Or the milk may be semi-solidified by the addition of a little hot solution of isinglass, flavoured with lemon-peel, and allowed to cool. Indeed, by a little ingenuity, milk may be presented in a variety of forms and flavours. If the patient is content and doing well with the milk diet there is no need to change it; but this will only exceptionally be the case, and the majority will grow tired of this exclusive diet, and insist on some change; and some will not digest it satisfactorily.

In such cases we may add to the dietary carbohydrates in the form of some agreeable vegetable food: we may allow some toasted bread and a little macaroni, rice or tapioca, or other farinaceous food. A little fruit or fruit-jelly may also be added, and in many cases, especially if the bodily nutrition seems to suffer from too restricted a diet, we may permit some addition to the nitrogenous constituents and fats, in the shape of the more delicate kinds of fish, a little chicken or white game, the yolk of an egg, grilled bacon, etc. In all cases we must look carefully to the digestive functions, and see that they undergo no serious disturbance; for we must bear in mind that any toxic substances formed during the digestive process may either irritate the kidneys in their elimination, or tend to poison the blood by their retention in the body.

We must not regard the decrease or increase of the amount of albumen in the urine as a reliable criterion of the suitability of any particular dietetic treatment. A systematic examination of the urine should be made at stated intervals, particularly of urea and chlorides, so as to gauge the power of the kidney to excrete its various waste products. The total excretion of urine also should be measured for a few consecutive days to ascertain how readily the kidney is voiding its water. But we must, at the same time, look to the *general condition* of the patient; and when that keeps satisfactory, and if the density of the urine is also satisfactory, we should not hastily conclude that the diet is unsuitable, because rather more albumen is excreted. So, on the other hand, although less albumen may appear in the urine, if the general condition of the patient is deteriorating, and the density of the urine keeps low, we may fairly doubt the propriety of continuing a severely restricted diet. Probably no greater dietetic error has ever been so tenaciously adhered to as that of prescribing strong animal extracts and broths for all kinds of invalids; and the immense number of preparations of this kind that is still being introduced to the notice of the profession and the public seems to indicate that there is no disposition to relinquish their employment.

It should be remembered that most of these preparations have little food-value, and that their mode of preparation ensures the extraction of any toxines that may be contained in the meat. We have often seen the pulse rise ten to twenty beats, and the arterial tension increase considerably, together with the appearance of much digestive discomfort, after the patient has partaken freely of some of these meat extracts. The soluble nitrogenous extractives they contain are in a condition to pass directly into the blood, and so to at once reach the kidneys, which they can scarcely fail to irritate; while they are calculated seriously to intensify the risk of uræmia.

They should be excluded from the dietary of the albuminuric.

Grainger Stewart, while he recognised the great value of milk as the most suitable food for these cases, was disposed to depart somewhat from the exclusively milk diet, and to allow a small proportion of white meat, pudding, and fruit to be added to the dietary. Some difference of opinion exists as to the suitability of fish for the albuminuric. Bulk for bulk, white meat and fish contain less proteids than the dark meats, and would therefore seem to be preferable; they are also more digestible. But recent observations of the urine failed to detect any constant difference in the nitrogenous output of the urine between the two varieties. As we have pointed out elsewhere,* "farinaceous foods, fish, vegetables and fruits, together with milk, butter, cream, and other fats, afford all that can be needed for the nutrition of the body," and a careful selection from this wide range should afford an ample variety of diet for our patients. Alcohol in any form would seem to be forbidden by the morbid state of the kidney; but seeing that only some 3–5 per cent. of a moderate allowance of alcohol is eliminated by the kidney, any strict and uniform prohibition would be misplaced. The stimulus to appetite and the aid it affords to digestion will not unfrequently greatly outweigh any conceivable damage to the kidney. In cases of profound heart weakness we would even go so far as to say that it may be urgently needed.

There is not very much to be said in favour of drug treatment in chronic Bright's disease, save to meet indications presented by particular symptoms or states which may arise during its progress. The measures appropriate to the treatment of uræmia, of dropsy, and of certain other symptoms which may occur in the course of chronic, as well as acute, cases, have been considered when discussing the treatment of the latter, and we have little to add to what was there set forth. *Diuretics* may be more freely used in chronic cases; and the use of mild alkaline waters may be especially commended for the purpose of exerting a diuretic action without causing renal irritation. A scanty secretion of urine from cardiac asthenia indicates the use of cardiac tonics, and *digitalis* may, in such cases, be found a valuable resource. The tincture, in doses of 10 to 15 minims twice a day, often advantageously combined with iron, is the best preparation. As Lépine has pointed out, it is as well in these cases to give this drug only on alternate days, or only on every third day, so as to allow of sufficient time for its elimination. *Caffeine* is also a good cardiac tonic and diuretic in these circumstances, and may be administered hypodermically up to 15-grain doses dissolved in sodium benzoate. Strophanthus and squill are to be avoided, as irritating to the kidneys. Grainger Stewart commended as a diuretic a combination of scoparius, digitalis, and potassium acetate; and he did not object to juniper and copaiba in the later stages. He considered nux vomica assisted their action. He also found a combination of iron and arsenic of great service for the anæmia and general weakness. Iodide of potassium and mercurials are indicated in syphilitic cases, and may effect complete cure.

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* *See* the author's "Food in Health and Disease," Part ii., Chapter ii., for a full discussion of this subject.

Attacks of intercurrent renal congestion, with the appearance of a certain amount of blood and an increase of albumen in the urine, are frequent, and during such exacerbations the stricter regimen of acute nephritis is required.

For draining off the fluid of dropsy a number of punctures with a sterilised surgical needle may be made over the dorsum of the foot, the ankle, and the leg, after which the leg should be wrapped up in warm, moist flannel, and allowed to drain. Raising the head of the bed by blocks of wood is practised by some in order to promote the draining away of fluid. Massage is of great assistance in the removal of renal anasarca. Large peritoneal accumulations will require to be removed by tapping.

The regular administration of saline aperients is of great importance, for the purpose of guarding against the retention of toxic substances in the blood, moderating vascular tension, and preventing the occurrence of uræmic symptoms; a full dose of white mixture (magnesium sulphate and carbonate) the first thing in the morning, is, perhaps, the best. It may, if necessary, be preceded by an aloes-and-soap pill at night. Potassium bitartrate and the compound jalap powder are also good aperients in these cases. Care is necessary not to impair the general strength by too lavish a use of aperients, or to excite an irritable catarrh of the bowel, to which there is some proneness in Bright's disease.

Numerous drugs have been administered in this disease with the object of diminishing the excretion of albumen; but the loss of albumen is not in itself so serious a matter, and attempts to reduce this loss by drugs are neither needful nor advisable.

Nitro-glycerine has been strongly recommended for the purpose of relieving giddiness and headache and other symptoms of high arterial tension, for which blood-letting has also been proposed. From $\frac{1}{2}$ a minim to a minim of the 1 per cent. solution should be given every hour or two for five or six times, and then less frequently. Lumbar puncture and withdrawal of a small quantity of cerebrospinal fluid will sometimes relieve in a few hours headache that has persisted for weeks without intermission.

Insomnia is often a serious burden to sufferers from chronic nephritis: a hot bath at bedtime is sometimes effectual, and of hypnotics we are disposed to recommend chloralamide. Twenty grains may be dissolved in a little brandy and administered in a wineglassful of warm water at bedtime. The drug is free from the depressing after-effects of chloral. West considers cannabis indica a good hypnotic in chronic renal disease, but it is at best an uncertain and unreliable drug.

But in the milder chronic cases of this form of Bright's disease it is on the judicious use of general hygienic measures that the chief reliance must be placed. The care of the general health, the regulation of digestion and alvine excretion, the promotion of the excretory functions of the skin, the regulation of clothing and exercise, the selection of a suitable climate, all these are of the greatest importance in promoting the restoration of such patients to health or in preventing the advance of the disease.

Of the food suitable to these cases we have already spoken, and on this point we have only to add that as improvement in health is established, a slow and gradual return to the ordinary diet may, with careful supervision, be permitted. Symptoms of dyspepsia are best treated by almost complete abstinence from food for a short time, a little thin peptonised oatmeal gruel only being taken; buttermilk has been found to be well borne in some of these dyspeptic states. Whey made with lemon-juice is also an agreeable, slightly nutritious drink. Suitable aperients must of course be given. Intestinal antiseptics may occasionally be of service when symptoms of flatulence and intestinal indigestion are prominent. Half a minim of creasote or a grain of thymol, in a pill with powdered soap, may be ordered three or four times a day when food is taken.

The functions of the skin must be promoted by hot baths—the safest and best is a very hot bath (as hot as can be comfortably borne), with a bag of bran wrung out in it, at bedtime; the patient, after a quick rub-down, should be wrapped up in a flannel dressing-gown or night-shirt, and at once sent to a warm bed. Dickinson * suggests a Turkish bath every week

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* Allbutt's "System of Medicine," vol. iv., p. 403.

or ten days—or a hot-air "leg-bath" (often more obtainable and convenient), as remedial or preventive of the headache, vomiting, etc., resulting from blood contamination. Dry friction of the skin in a thoroughly warm room on getting up in the morning should be prescribed; if a morning bath is taken, it should be tepid or warm. An albuminuric patient in the English climate, in winter, may very profitably pass much of his time in bed, or in one warm room. Prof. Semmola, of Naples, confined such patients during winter to one large room, the temperature of which was kept constantly between 60° and 68° F. Von Noorden, however, is of opinion that fresh air and a moderate degree of muscular exercise are decidedly beneficial in maintaining tone of the muscular system and heart, and as a means of ensuring better aëration of the blood and freer elimination by the lungs. In cases, however, in which albuminuria is profuse or dropsy present, a large amount of rest and recumbency is imperative.

Warm clothing should, of course, be insisted upon; woollen garments should be worn next the skin, and a broad woollen band round the loins is an additional protection.

It is a great advantage to these patients to be able to change to a **more genial climate** in winter and spring.

It is common to recommend such patients to winter in one of the resorts on the Riviera, or in Algiers or Egypt, and although these resorts may be better than any place within English shores, they are not the very best climates for the albuminuric, as they all lack that equability of temperature which is so beneficial. The best climate for the subjects of chronic Bright's disease is a somewhat humid, warm, equable one, which will exercise a decided influence in promoting the activity of the skin. Madeira, Orotava, the Azores are the most accessible of such climates to English patients, but the most perfect resorts of this kind are to be found in the West Indies, and surprising benefit often follows a prolonged residence there.

(*b*) *Chronic Interstitial Nephritis*

This is the form of chronic Bright's disease which is associated with the small, contracted, cirrhotic, "gouty" kidney, together with general arteriosclerosis and cardiac hypertrophy. Its causes are chiefly gout, lead-poisoning, and alcohol, and perhaps we may add persistent excess of albuminous foods. Its occurrence in early life is infrequent; it is unusual to meet with a typical case under 30; it is most common between 40 and 60 years of age, less so between 60 and 70, and rare after the latter age. It is more frequent in males than in females, in the proportion of about 2 to 1.

This disease is always insidious, and is often involved in much obscurity at its commencement, while its course is characterised by extreme slowness. The disease may exist in an advanced degree, and the patient yet present great bodily and mental power. The earliest symptoms are usually those of disturbed general health. There is a sense of lassitude and weariness, the patient is sleepless, and complains of having to get up once, twice, or oftener during the night to pass water. The tongue is generally dirty, and the digestion is disturbed; there is a tendency to dyspnœa on exertion; headache and troubles of vision are also complained of.

The **urine** is generally increased in quantity, except in the last stages of the disease, and there is increased thirst. It is pale, clear, and of low density, 1005 to 1012. It rarely contains much albumen, and careful and delicate testing is required to discover it. Albumen may occasionally be entirely absent, especially in that passed in the early morning, assuming thus the "postural" character. Blood will be found in the urine in the hæmorrhagic interludes that commonly occur in the course of granular kidney. Tube casts are not always present, but usually a few hyaline or granular casts may be found. The amount of urea is often, but not always, diminished. The pulse is hard from increased arterial tension, and the wall of the artery is commonly thickened. Continuous high arterial tension is one of the earliest and most important symptoms of this form of chronic Bright's disease. The presence of cardiac hypertrophy is another almost constant feature; the left ventricle hypertrophies to overcome the resistance in the arteries. The first cardiac sound at the apex may be re-duplicated, but more commonly the second sound in the aortic area is strongly accentuated.

Intercurrent affections of other organs are common. Sudden œdema of the glottis; pleural effusions; sudden œdema of the lungs; nocturnal dyspnœa and renal asthma; acute pneumonia, pleurisy, bronchitis; uncontrollable vomiting; severe diarrhœa; *cerebral hæmorrhage*; visual troubles, retinal hæmorrhage, retinitis, etc., may occur, cerebral hæmorrhage and retinal changes being especially common. Epistaxis has often been noted as an early premonitory symptom. *Dropsy* is rare, and when it occurs it is usually either due to cardiac failure in the advanced stages, or to the "supervention of *parenchymatous nephritis* upon antecedent cirrhosis." Eczema is common.

The chief clinical features which distinguish this from the preceding form of chronic Bright's disease are its slower progress and usually insidious onset, the small amount of albumen in the urine, the infrequency of general dropsy, and the constant coexistence of cardio-vascular changes.

The following **indications for treatment** are deducible from the preceding brief description of the general characters of the disease:—

1. In the early stages, to relieve the heart, arteries and kidneys from further strain and irritation.

2. When there are evidences of greatly increased arterial tension, to lessen it.
3. To strengthen and support the heart when signs of dilatation and failure appear.
4. To promote the elimination of toxic substances, especially when symptoms of uræmic intoxication supervene.

1. The treatment in the early stages must be mainly regiminal and dietetic. An *exclusively milk diet* is unsatisfactory in this class of patient; at the same time the diet should be regulated to some extent on the principle of giving those foods which will leave but little nitrogenous waste to be eliminated. Milk and farinaceous foods, in light and digestible forms, well-cooked fresh vegetables, and such fresh salads as lettuce and watercress, with raw or cooked fruits, should comprise a large part of the daily dietary. Animal food, to the extent of 3 or 4 ounces of well-cooked meat, may be taken once a day, and this should rarely be exceeded; but we must not be too absolute, and in all cases we must study the individual digestive capacity and the special nutritive needs of the constitution. It is generally held that spices and condiments are irritating to the kidneys; von Noorden forbids white and black pepper, cayenne pepper, English and German mustard, curry, cloves, nutmeg, anise, caraway, leek, garlic, celery, and truffles.

All alcoholic drinks must, as a general rule, be carefully restricted or even forbidden. Granular kidney is as much a cardio-vascular as a renal disease, and alcohol is as harmful to the heart and blood-vessels as it is to the kidney. Tea, coffee, and cocoa may be permitted in strict moderation. Excessive intake of fluid of any kind will only add another burden to the heart. A good wash-out for 48 hours once or twice a month will go far to prevent accumulation of waste products. Then weak alkaline mineral waters should be drunk freely. Vals, Vichy, Apollinaris waters are all useful for this purpose; they may be taken mixed with milk, or with a little added lemon-juice. When there is much dyspeptic trouble, with a dirty tongue and foul breath, it is a good plan to give a small tumblerful of warm Apollinaris water half an hour or an hour before the principal meals.

It is *most important* to see that there is free daily evacuation of the bowels. Straining at stool has often induced cerebral hæmorrhage. No harm can arise, but much good, from a little free purgation occasionally; at any rate, constipation should never be allowed to go unrelieved. A dose of Apenta water or of Carlsbad or other aperient salts, or of the familiar "white mixture," should be taken if necessary every morning, and this may be rendered from time to time more effective by an aloetic pill the night before. The functions of the skin should be promoted by a daily tepid bath, followed by brisk friction of the surface; the underclothing should be warm, and suited to the season. Overclothing in warm weather, so that the body is in a constant state of perspiration, is a fertile cause of chills. All mental excitement and business strain or worry should be, so far as possible, avoided. Gentle exercise in the open air, in fine weather, is advantageous, but the patient must be warned against all violent or excessive exercise, which is most injurious, as it not only increases the amount of nitrogenous waste to be secreted, but it throws additional strain on the hypertrophied heart and sclerosed arteries, and increases the risk of vascular rupture, always more or less imminent in these cases.

In order that the patient may have the advantage of the decidedly tonic influence of gentle exercise, or of sitting out a good deal in the open air, a residence during winter in a more favourable climate than that of Great Britain is indicated. We have already referred to such climates in speaking of parenchymatous nephritis. Osler recommends southern

California as a permanent residence for American patients

So far as medicines are concerned, it is doubtful if we can do much more in order to respond to this first indication than give, as we have pointed out, mild alkaline diuretics and regular aperients.

Many physicians, however, have a firm belief in the usefulness of **potassium iodide** in checking the progress of arterial sclerosis. Profs. Bartels, Germain Sée, and Semmola have strongly supported its use, and the latter has prescribed the following as a drink for such patients : potassium iodide, 15 to 20 grains ; sodium phosphate, 30 to 45 grains ; sodium chloride, 1½ drams ; to be dissolved in a quart of drinking water.

There are certain cases of albuminuria, not very rare, in which gout and constitutional syphilis are combined ; in such cases the use of potassium iodide is attended with great improvement.

2. To lessen excessive arterial tension, potassium or sodium iodide will certainly often prove most useful. It has been well pointed out that in our efforts to correct excessive high tension we must not fall into the opposite error of greatly lowering the tension, for in that case the risk of effusion into serous cavities is greatly increased ; but we should aim at a happy medium. The action of the skin should be promoted by hot baths (some take objection to hot-air baths as likely to induce uræmia), followed by envelopment in blankets, as already mentioned. The food should be very light and unstimulating, and a saline purge should be frequently given.

Nitro-glycerine is now largely employed to relieve vascular tension ; 1 minim of a 1 per cent. solution may be given three times a day, and the dose increased according to the tolerance of the patient for this drug, which varies very greatly. It not only relieves the arterial tension, but it coincidently relieves the dyspnœa, the headache, and the dizziness. Small doses of tincture of aconite, 2½ to 5 minims, every three hours for a time, have been recommended for this purpose.

3. Anæmia, and a tendency to cardiac dilatation and failure, are often present in the more advanced stages of the disease. For the anæmia, when that is a prominent symptom, iron is needed. It may often be wisely combined with digitalis; but we must be careful not to raise vascular tension to a dangerous degree. Weir-Mitchell has found large doses of the tincture of perchloride of iron, 30 to 60 minims three times a day, very beneficial in such cases, and he considers it an important means of reducing arterial tension.

We entirely agree with Dickinson that iron should not be administered as a matter of routine, as it often seems to be, but only when an obvious condition of anæmia exists, and with careful avoidance of constipation.

Strychnine is also an excellent cardiac tonic in these cases: it may be given in combination with digitalis and iron, or it may be injected hypodermically (5 minims of liquor strychninæ).

4. We have already, in preceding sections, dwelt on the appropriate treatment of uræmic manifestations. In the cases we are now considering, we perhaps more frequently meet with the slighter and more chronic manifestations of the approach of these ultimate troubles, such as headaches, restlessness or drowsiness, palpitations, cramps, attacks of nocturnal dyspnœa (renal asthma), and nausea and vomiting with foul tongue and loaded breath. In these, as in other cases, to promote elimination is the paramount indication; the production of free purgation and copious perspiration, by the means already pointed out, should be our first care. Pulmonary apoplexy and hæmoptysis call especially for saline purges, and magnesium sulphate is the best. To relieve arterial tension we may use nitro-glycerine; this also, and

nitrite of amyl, may be used to relieve the attacks of uræmic dyspnœa; inhalations of chloroform will also be useful to relieve this condition, as well as the severe uræmic convulsions. Chloral may also be given to allay uræmic convulsions, either by the mouth or, when this is not practicable, by the rectum. We have already pointed out the utility of blood-letting and of lumbar puncture in certain cases.

Caffeine will often relieve the headaches and vomiting of uræmia. Dr. West * is somewhat enthusiastic about the value of nitrate of pilocarpine in these cases, given in small doses by the mouth twice or thrice daily. He has found it relieve the headache, vomiting, irritability of temper, and nocturnal restlessness. This writer also urges the trial of *renal extracts*, on the hypothesis that the kidneys may produce an internal secretion; he states he has tried them in a few cases, and found their use attended with an increase in the amount of the urine and an improvement in the general condition. We do not ourselves anticipate any considerable therapeutic gain in this direction.

In a severe paroxysm of renal asthma Dr. Kirk, of Glasgow, found the withdrawal of 15 ounces of blood by venesection was followed by immediate and complete relief.

Delirium and restlessness may be best relieved by the administration of chloral, or chloralamide combined with sodium bromide. It used to be taught that there was great risk of inducing fatal cerebral symptoms if opium or morphine were given to patients with chronic Bright's disease; and we have ourselves seen a rapidly fatal result follow the administration of a small dose of opium, given to relieve the nocturnal dyspnœa in a case of this kind. However, Osler, Mackenzie, Loomis, and others maintain that it is quite safe and proper to give morphine in uræmic states. We have already considered the propriety of its use in the control of acute uræmic convulsions. Yet we cannot help fearing that, if opium and morphine are used freely for the slighter and less urgent manifestations of this state, the restlessness of uræmia will occasionally be relieved by the repose of death. We should sanction their use with extreme reluctance, and then only in very small doses, unless they are employed simply to promote euthanasia! Hyoscine hydrobromide we should regard as a safer drug, $\frac{1}{200}$th grain given hypodermically.

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* "Granular Kidney," pp. 161 and 162.

ADDITIONAL FORMULÆ

In acute Bright's disease

℞ Infusi jaborandi (1 in 45) ad ℥vj.
Syrupi aurantii, ʒv.

M. f. mist. A tablespoonful every hour or two. (*Bamberger.*)

For anasarca in acute Bright's disease (after the acute symptoms have subsided)

℞ Tincturæ ferri perchloridi, ʒvj.
Liquoris ammonii acetatis, ℥iij.
Aquæ chloroformi, ℥vj.

M. f. mist. A tablespoonful in a wineglassful of water every four hours. (*Whitla.*)

Diuretic in acute Bright's disease

℞ Potassii citratis, ℥ss.
Infusi digitalis, ℥ij.

M. f. mist. Two teaspoonfuls in aërated water every three hours.

(*Prof. A. H. Smith.*)

As a diuretic in Bright's disease

℞ Tincturæ digitalis, ℥ss.
Vini scillæ, ℥jss.
Spiritus ætheris nitrosi, ℥ij.

M. A teaspoonful in water every three or four hours.

(*Millard.*)

In chronic Bright's disease

℞ Potassii iodidi, gr. xv.
Sodii phosphatis, gr. xxx.
Sodii chloridi, gr. lxxv.
Aquæ ad ℥xx.

M. f. mist. To be taken in the twenty-four hours.

(*Semmola.*)

Tonic and diuretic

℞ Tincturæ ferri perchloridi, ℥ss.
Acidi acetici, ʒss.
Liquoris ammonii acetatis, ℥v.
Curaçoæ, ℥ij.

M. A teaspoonful in water thrice daily. (*Da Costa.*)

Hydragogue purge in Bright's disease

℞ Potassii tartarati, ʒj ad ʒjss.
Jalapæ pulveris, gr. viij.
Cambogiæ pulveris, gr. j.

M. f. pulv. To be taken night and morning. (*Baskell.*)

In Bright's disease

℞ Pilocarpinæ hydrochloridi, gr. j.
Sacchari lactis, gr. x.

M. et div. in pul. x. One three times a day. (*Baskell.*)

Tonic pills in chronic Bright's disease

℞ Ferri sulphatis, gr. lxxv.
Sodii bicarbonatis, gr. lxxv.
Extracti taraxaci, q.s.

M. et div. in pil. lx. Take three pills night and morning. (*Bamberger.*)

In uræmia

℞ Acidi benzoici, gr. vijss.
Sacchari albi, gr. lxxv.

M. et divide in pulv. vj. One every two hours. (*Bamberger.*)

PART VII.—DISEASES OF THE NERVOUS SYSTEM

CHAPTER I

TREATMENT OF DISEASES OF THE BRAIN AND ITS COVERINGS

TUBERCULAR MENINGITIS.—Its Nature and Seat—A Bacillary Infection—*Symptoms*, in Children; in Adults—*Treatment*, to be of any use, must be applied early—Potassium Iodide—Iodoform Ointment—Mercurial Inunction—Surgical Treatment.

SUPPURATIVE MENINGITIS.—Causes—*Symptoms*—Indications for *Treatment*—Sedatives—Antipyretics—Diet—Surgical Methods—Antisera.

APOPLEXY (*Cerebral Hæmorrhage, Embolism and Thrombosis*).—Nature of the Apoplectic State—Its Causes—Hæmorrhage from Arterial Degeneration—Relation to Chronic Renal Disease—*Symptoms*—*Treatment* in the Attack—Indications For and Against Blood-letting—Purgatives—Management of the Stage of Reaction—Use of Hæmostatics, Ergot, etc.—Syphilitic Cases—Embolic Cases—Treatment on Recovery from the Attack—Treatment of HEMIPLEGIA—Of Muscular Rigidity and Contractions—Use of Electricity—Diet and Regimen—Thermal Treatment—Preventive Measures—Surgical Proposals.

INTRACRANIAL TUMOUR.—Different forms of Intracranial Tumour—Etiology—*Symptoms*—Course—*Treatment*—Anti-syphilitic Measures—Cases suitable for Surgical Operations—Trephining as a Palliative Measure—Lumbar Puncture. Additional Formulæ.

THE scope for active therapeutic intervention is limited in some diseases of the central nervous system; and, as our main object in this work is to deduce *indications for treatment* from a consideration of the nature, causation, and phenomena of disease, we shall confine ourselves, in this chapter, to a brief survey of those affections only which admit of remedial interference or management on the part of the *physician.*

We shall also have to assume that the diagnosis—which, in some forms of these diseases, may necessitate a long and detailed examination, and a careful analysis of a complex group of symptoms—has been accurately made.

In the first place we propose to consider the treatment of the most frequent and most fatal of those affections—

TUBERCULAR MENINGITIS

This disease, at one time commonly but wrongly described under the name of "*acute hydrocephalus,*" from the fact that an accumulation of sero-purulent fluid in the ventricles of the brain is a frequent consequence of the affection, is really an inflammation of the membranes of the brain, due to **infection** by the *tubercle bacillus,* combined in a few cases with infection by the streptococcus and staphylococcus.

The deposition of tuberculous nodules, surrounded by inflammatory exudation, is more abundant at the base of the brain than elsewhere; and from this situation it may extend, more or less widely, over the convex surface of the brain, and along the pons and bulb to all parts of the spinal canal. It also extends along the choroid plexuses into the ventricles. The fluid in the ventricles is increased, and its character altered; and the surrounding brain substance is often the seat of some encephalitis.

Meningeal tubercle rarely occurs independently of some other local tubercular lesion, or apart from general tuberculosis. The causal relations of this disease therefore fall under those of tuberculosis generally.

The chief symptoms of this disease, as observed in children, are the following: After two or three weeks, or longer, of what are regarded as *premonitory* symptoms, such as emaciation, restlessness, loss of appetite, disordered bowels, peevishness, languor and dulness, and sometimes headache and drowsiness, the symptoms of the onset present themselves; the earliest being usually vomiting, then convulsions, and then severe headache, so severe, at times, that the child, while putting its hand to its head, utters a short, sudden cry —the "hydrocephalic cry"—or he may go on screaming continuously. The patient usually lies huddled up on his side, and the increased tone of his flexor muscles offers considerable resistance when an attempt is made to straighten the limbs. There is constipation, and usually a furred tongue. The temperature commonly fluctuates between 101° and 103°; and the pulse at first quickened, may become irregular and slow. The pupils are often unequal or contracted. This "*stage of irritation*" is followed by a "stage of pressure." There is loss of consciousness; frequent grinding of the teeth; pupils dilated and insensible; there is general loss of muscular power, and evidence of paralysis of one or more of the cranial nerves may appear, as ptosis and squint. Optic neuritis is frequently revealed on ophthalmoscopic examination. Notable abdominal retraction is observed in this stage. Irregularities in the pulse and respiration are common. Finally, the coma and paralysis increase; convulsions and spasmodic muscular contractions, especially of the muscles at the back of the neck, are frequent, causing retraction of the head, and regarded as indicating a posterior basal form; and a general typhoid state sets in, with dry tongue, rapid pulse, and low delirium. Remarkable subnormal temperatures have been noted in this stage, and occasionally high ones, 106° to 107°. Now and then a marked but brief remission in the serious symptoms takes place, and false hopes of recovery are excited.

In *adults*, the onset is usually gradual and insidious; but the acute invasion may be very quickly fatal.

Occasionally some local paralysis, as of the facial nerve, or hemiplegia, may be one of the first symptoms.

In tubercular meningitis the cerebro-spinal fluid, withdrawn by lumbar puncture, is increased in quantity, contains albumen, a large excess of mononuclear lymphocytes, and often tubercle bacilli. An excess of polymorphonuclear leucocytes generally indicates a secondary infection with another organism.

The first question which arises in regard to the **treatment** of tubercular meningitis is this : Are we to consider this disease as necessarily and inevitably fatal, or may we entertain the belief that recovery is possible? Cases, few in number it is true, have been reported in which all the symptoms of this affection were undoubtedly present, and yet the patients recovered ; and in two or three rare instances the opportunity for subsequent post-mortem examination has proved that the diagnosis of the nature of the original attack was correct.* On the other hand, cases in which tubercle bacilli have been found in the spinal fluid have almost invariably proved fatal, and the greater number of authorities believe this to be an incurable disease. Osler says, "I have neither seen a case which I regarded as tuberculosis recover, nor have I seen post-mortem evidence of past disease of this nature." Niemeyer is more hopeful ; he says, "Even excepting the cases where the diagnosis was somewhat uncertain, there is no doubt that recovery has occurred." Dujardin-Beaumetz maintained the same view, and quoted, in support of this opinion, a case that was under his own care, in which, during the acute attack, ophthalmoscopic examination by Meyer revealed the presence of tubercles in the choroid. This man made a complete recovery.†

All physicians are, however, agreed that, if therapeutic intervention is to be of any service, it must be during the earlier stages of the malady, and that there can be no chance for curative measures when extensive inflammatory exudation and alteration of the membranes and brain substance have taken place.

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* *See* Fagge's "Practice of Medicine," vol. i., p. 646.

† "Clinique Thérapeutique," vol. iii., p. 248.

The prophylaxis of this form of tuberculosis in the children of tuberculous parents falls under the same considerations as have already been dwelt upon when treating of the prophylaxis of phthisis. Especial attention should be paid to the presence of tuberculous glands in the neck, which may have to be removed as a precautionary measure, if they resist the usual hygienic and medicinal measures.

Of the remedies that have been suggested as especially applicable to the treatment of tubercular meningitis, **potassium iodide** stands foremost. So careful and cautious an observer as Niemeyer believed he had seen two cases recover under its administration. He recommends that it should be given in large doses and for a long time. In children we may give, according to the age, from 1 grain to 5 grains three or four times a day, and in adults as much as 10 to 15 grains. Niemeyer noted that in the cases in which recovery followed its use there was a very extensive iodine eruption and an iodine catarrh of the nose, and that these signs of iodism were absent in the non-successful cases.

We have always thought it somewhat remarkable that whenever the administration of potassium iodide leads to the cure of disease, the idea of syphilis instantly springs to the minds of most physicians. This is surely a sign of singular narrowness of view. If potassium iodide is so remarkable an antagonist to the syphilitic poison, and supposing syphilis to be caused by a pathogenic microbe, why should it not act similarly towards some others? Why should we assume that it can *only* counteract syphilitic infection? Why may it not be, in circumstances (at present unknown) particularly favourable to its action, an efficacious antidote to tubercular infection? A syphilitic node melts away and disappears under its use; why not a tuberculous nodule? The answer, of course, to this is, that tuberculous nodules, in other situations, are not observed to disappear under the influence of potassium iodide. This is true in a certain sense, but it is not true *universally*, because this drug has not been tried in a sufficient number of cases to warrant the conclusion that it might not, under certain conditions especially favourable to its action, lead to their disappearance. *Mercury*, preferably applied by inunction, is a favourite remedy. A dram of the mercurial ointment may be applied to the abdominal surface on a binder daily. Internally the perchloride may be given in doses of $\frac{1}{16}$th of a grain in combination with 3 or 4 grains of potassium iodide.

Reports have been published of cures of this disease following the inunction of iodoform ointment, and in an affection which is generally so fatal a suggestion of this kind should surely be given a fair trial. Whitla* relates a case, the daughter of a hospital nurse, who was believed to be dying from tubercular meningitis, and "after profound coma and squint had lasted several days" he caused "a quantity of mercurial ointment" to be rubbed in. "As a free and copious secretion of saliva poured out of the mouth some hours afterwards, the patient opened her eyes after a short time, and rapidly gained consciousness and made a speedy recovery." It is worth remarking that, just as notable *iodism* occurred in Niemeyer's successful cases with potassium iodide, so notable *salivation* occurred in Whitla's successful case with mercurial inunction. Our views as to the curability of tubercular peritonitis have undergone a remarkable change; it may be that those entertained with regard to tubercle of the meninges are destined also to great modification. Hot sponging, or the application of one or two leeches, has been found to give relief to the pain in the head.

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* "Dictionary of Treatment," p. 516.

For constipation small doses of castor oil or of grey powder, or enemata, may be required; and for the convulsions a combination of chloral with bromides is useful. The administration of food is often attended with difficulty, and it may be necessary to resort to nasal or rectal feeding.

A proposal to treat surgically tubercular meningitis, on the same lines as those adopted in the treatment of tubercular peritonitis, has been seriously entertained by Senn, of Chicago, and Keen, of Philadelphia. The former would tap with a small trocar, under strict antiseptic precautions, and inject 2 drams of a 10 per cent. iodoform glycerine emulsion, "practically the same treatment which has proved so successful in tuberculosis of the joints." Keen would open the skull, tap the ventricles, irrigate and drain.* Puncturing the subarachnoid space between the third and fourth lumbar spines and evacuating the fluid has been attempted in this country and in Germany, and in the latter country some success has been reported from this operation, but the results cannot be said to have been very encouraging. Inasmuch as this procedure is often necessary for the purpose of confirming the diagnosis, and as it frequently relieves symptoms for a time, it should be performed in most cases.

Such are the chief points to be noted in the special treatment of tubercular meningitis; its *general* treatment must be conducted on the same principles as apply also to non-tubercular forms, which we propose, in the next place, to briefly examine.

SUPPURATIVE MENINGITIS

Suppurative meningitis may arise in a variety of circumstances; the majority of cases are now commonly referred to various forms of bacterial infection, *i.e.* (a) *diplococcus pneumoniæ*, such cases occurring either as a complication of lobar pneumonia, or infective endocarditis, or even as a primary infection; (b) the *streptococcus*, most frequently associated with the preceding, and the *staphylococcus*. (Those due to the various forms of the *diplococcus intracellularis* will be considered separately. *See* page 771.) Some of these infections may arise through traumatism and in chronic disease of the bones of the skull, especially with mastoiditis following inflammation of the middle ear. It is sometimes an extension of the infection of erysipelas of the scalp. Cases occasionally occur, not referrible to any of the foregoing causes, which have been, on that account, termed *idiopathic*.

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* Hare's "System of Practical Therapeutics" (new edition,) vol. ii., p. 725.

The **symptoms** of the non-tubercular forms of meningitis bear a general resemblance to those of the tubercular variety; those most commonly present are severe and continuous headache, delirium, rigidity, and spasm or twitchings of the muscles, convulsions (not so common as in the tubercular form), stiffness and retraction of the muscles of the neck, vomiting (frequent in the early stage), constipation, optic neuritis (when base is involved). Local paralysis from lesions to nerves at the base may be present, such as ptosis, squinting, facial palsy, etc. The pupils, contracted in the early stage, become, later on, dilated or unequal. There is usually pyrexia, and the temperature may rise to 103° or 104° F. The non-tubercular form is not considered so hopeless and necessarily fatal as the tubercular form. The cerebrospinal fluid in these cases is usually in excess, and contains large numbers of polymorphonuclear leucocytes as well as the cocci responsible for the disease.

The general **treatment** of these cases applies equally well to all forms of meningitis.

The patient should be put into a darkened, quiet, airy room, in a comfortable bed, with his head raised; his bowels should be at once freely opened by a few grains of calomel and a saline purge, which may be advantageously repeated from time to time. To check vomiting in adults, an effervescing mixture, with an excess of sodium bicarbonate, and 10 grains of sodium bromide and a dram of cherry-laurel water in each dose, should be given every three or four hours, and the patient may also suck fragments of ice. With vigorous children a leech or two behind the ears will certainly do no harm, and may help to relieve the headache. The head should be shaved, or the hair cut short, and cold continuously applied, by means of either Leiter's tubes or a well-adapted ice-bag. Mustard plasters to the nape of the neck have been found to relieve pain and restlessness. Besides the sodium bromide in the above mixture, some additional sedative to the nervous system may be useful; small doses of morphine may be injected hypodermically ($\frac{1}{24}$th to $\frac{1}{6}$th grain in the adult), or enemata of chloral (15 to 45 grains) dissolved in water, with an equal quantity of potassium bromide, may be given, or chloroform inhalations may be of use to relieve pain and allay convulsions. Frequent small doses of antipyrin or exalgin may prove useful in relieving pain in the head; paraldehyde has been stated to be valuable as a sedative in traumatic and chronic alcoholic cases.

If it is thought desirable to administer antipyretics to reduce the temperature, we consider a combination of quinine (the hydrobromide) and phenacetin the best; 1 grain to 3 grains of each may be given, in infective cases, every two or three hours; the patient should at the same time be sponged with cold or tepid water. But in the earliest stage, in children, we prefer a few small doses of tincture of aconite or of aconitine for this purpose. The diet in these cases should be of the simplest; milk mixed with iced water is the best food. In the later stages, with much general depression, beef tea, wine, and other stimulants and restoratives may be called for. Rectal feeding will be necessary when it is not possible to give food by the mouth. Convalescence in those rare cases that recover must be watched carefully, and every possible precaution taken to avoid excitement and to maintain a long period of absolute repose; suitable tonic remedies may, after a certain time, be needed.

So much for the general treatment of these cases. When the infection of the meninges can be traced to a definite source, such as suppuration of the mastoid or of the frontal sinus, the focus must be treated surgically in order to arrest further infection. In the second place it is highly desirable that the nature of the pyogenic organism should be ascertained, and this must be done by a bacteriological examination of the cerebro-spinal fluid. According to the result of investigation the subcutaneous injection of a corresponding anti-serum is indicated, although in many cases the disease is so rapid that this therapeutic measure has hardly a fair chance of proving its efficiency. In the meantime it is worth while to replace some of the fluid, withdrawn by lumbar puncture, by a weak antiseptic solution, by normal saline solution, or by horse serum. Ten c.c. of a 1 per cent. solution of lysol may be used for this purpose, and repeated on successive days.

APOPLEXY

(*Cerebral Hæmorrhage, Embolism, and Thrombosis*)

There are many questions, of great pathological interest and importance, surrounding the subject of cerebral hæmorrhage and disorder of the cerebral circulation, which cannot be referred to, even briefly, in a work strictly limited in its object and purpose, as this is. We must here confine ourselves closely to those details which bear, more or less directly, on the therapeutic management of the diseased conditions which arise in consequence of the occurrence of the lesions mentioned in the title of this section.

Apoplexy, which is the name for a clinical, rather than a pathological conception, refers to a sudden loss or suspension of consciousness and power of motion.

These may, however, be suspended, as in certain intoxications, without apoplexy; for, in the latter, this loss is assumed to be *sudden*, as by a "*stroke*."

Again, although apoplexy and cerebral hæmorrhage have been regarded as convertible terms, strictly speaking they are not so; for a small hæmorrhage, in certain districts of the brain, may cause hemiplegia without loss of consciousness; and even in some cases of large hæmorrhages, slowly poured out (ingravescent apoplexy), there is no "stroke," or *sudden* loss of consciousness, but the so-called apoplectic state develops gradually, and it may be some hours before loss of consciousness and motion is complete and profound coma is established.

Although the apoplectic state is usually caused by the rupture of a cerebral vessel and hæmorrhage into the substance of the brain, or on its surface, yet it may also arise without the existence of cerebral hæmorrhage; and cases have been observed where hemiplegia and coma, and even *sudden* loss of consciousness, have been caused by obstruction to the cerebral circulation, and the cutting off of the blood supply (anæmia) of a certain portion of the brain, without any vascular rupture. We must, therefore, admit obstructive anæmia and softening from cerebral embolism or thrombosis as also a cause of apoplexy; and there is evidence to prove that syphilitic arteritis may likewise give rise to the same phenomena.

As a rule, we have to rely on collateral circumstances in order to enable us to distinguish which of these causes is in operation. An apoplectic seizure, in a person over forty years of age with increased arterial tension, may, with exceptions, be assumed to be due to hæmorrhage. In younger persons, if we find a history of cardiac valvular disease, there is a presumption in favour of embolism. But we must not overlook the fact that hæmorrhage may result *indirectly* from embolism, or from thrombosis, owing to the formation of an aneurysm on the obstructed artery and to the softening of the surrounding tissue. If, on the other hand, we find in these younger patients evidences of constitutional syphilis, we may suspect the apoplectic attack to be due to syphilitic arteritis and thrombosis.

Cerebral hæmorrhage, from arterial rupture, being the commonest cause of apoplexy, we must next inquire, what is the cause of this hæmorrhage? Disease of the cerebral vessels, chronic arteritis, usually associated with general arterio-sclerosis, and, in Great Britain, often found associated with chronic renal disease (contracted, granular kidney), is the main cause of cerebral hæmorrhage. These morbid changes in the arteries may originate in chronic alcoholism, in syphilis, or in over-exertion — prolonged muscular strain, as in athletic competitions, and severe and sustained physical labour. Old age also naturally brings these degenerative changes in its train. We believe that in some instances general arterial changes are determined by hereditary influences, and it is certain that some families are particularly liable to early arterial degeneration. We also believe that malarial and other forms of recurrent pyrexia are apt to lead to degenerative arterial changes. We have already considered these questions in the chapter on arterio-sclerosis.

The much greater frequency with which the occurrence of cerebral hæmorrhage is observed to be associated with chronic gouty kidney in England than on the Continent may probably be accounted for by the far greater prevalence of gout amongst the population of this country. Given the existence of a morbid state of the cerebral vessels, it is easy to see how the hypertrophied heart and heightened vascular tension of chronic renal disease greatly increase the risk of cerebral hæmorrhage from rupture. Charcot and Bouchard have shown that in a number of cases the hæmorrhage is *directly* due to the rupture of *miliary aneurysms*, which form on the trunk or branches of these diseased vessels.

The following are the most important **symptoms** that accompany and follow an apoplectic seizure. Without any warning, and perhaps while engaged in some action requiring rather more than usual muscular effort, the person attacked with apoplexy falls to the ground, paralysed and unconscious. Sometimes the loss of consciousness may not come on till a few minutes after the paralysis. The loss of consciousness is complete and profound. The face is usually livid or congested ; the pupils may be small, dilated, or unequal (the larger being usually on the side of the lesion), and insensible ; the respiration slow and stertorous ; the pulse may be full, slow, and hard ; the temperature may fall below the normal, or, in hæmorrhage at the base, it may be high ; the evacuations are passed involuntarily ; there may be slight twitchings of the muscles, but convulsions are rare ; on examining the limbs, more or less complete paralysis of one side of the body will be discovered, and it will be noticed that the cheeks are greatly puffed out during expiration ; the head and eyes are often turned strongly to one side—the patient is said to look towards the lesion ! In some cases, the so-called "*ingravescent*" ones, in which we may suppose the hæmorrhage to be slowly poured out, the attack is developed very gradually ; and it may be some time before complete loss of consciousness and muscular paralysis are established.

Within the next forty-eight hours some febrile reaction may occur, and the temperature may rise many degrees, even up to 107° or 108°—a very unfavourable sign ; and some *rigidity* may be observed in the paralysed limbs.

When the hæmorrhage has been extensive, and very serious injury has been inflicted on the surrounding structures, the coma may deepen, the febrile reaction may be very great, bed-sores may form rapidly, the presence of albumen and sugar may be detected in the urine, and death may speedily ensue.

On the other hand, a fall of temperature on the third or fourth day and a return of consciousness are favourable signs. The subsequent course of the case depends on the extent and site of the lesion. If the lesion is slight the hemiplegia may disappear altogether in a few days or a few weeks. The facial paralysis is usually the first to disappear, then that of the leg, then that of the shoulder and upper arm, and finally, that of the fore-arm and hand; but this sequence is not invariable, depending, as it does, on the situation of the hæmorrhage. In chronic cases, where improvement is slow to appear, *contracture* of the muscles of the paralysed limbs, most marked in the upper extremity, comes on within eight or ten weeks. Some pain in the affected limbs usually attends the development of these contractures, which rarely entirely disappear, although they may be somewhat remedied, as we shall see, by suitable treatment.

With regard to a **preventive** treatment of apoplexy, it is scarcely necessary to say that it cannot *openly* be entertained, except in the case of a patient who has already had an attack; for to suggest to a patient that he was in danger of apoplexy would, perhaps, be one of the most certain means of inducing an attack. The mental anxiety and distress which such an announcement would be almost certain to produce would, necessarily, be most prejudicial, and would be calculated to increase, rather than diminish, circulatory excitement. On the other hand, the rational treatment which would be prescribed by any intelligent and practical physician, when consulted by a patient suffering from those degenerative changes, or those constitutional or local diseases which involve the danger of cerebral hæmorrhage, would obviously be devised and directed to protecting him from *all* the morbid tendencies or accidents to which he was exposed. The preventive treatment of apoplexy can, then, only be the rational and appropriate treatment of those morbid conditions which we have mentioned above, and which have been dealt with in other chapters.

The practice of drugging a patient with arsenic, aconite, veratrum viride, digitalis, strophanthus, or strychnine, etc., with the sole view of preventing an attack of apoplexy with which he may be supposed to be threatened, is to be strongly deprecated.

The **treatment** of cerebral hæmorrhage may be considered in the following circumstances:—First, at the onset of the apoplectic attack, and during the stage of unconsciousness; secondly, during the period of febrile reaction; thirdly, on recovery of consciousness immediately after the attack; fourthly, the treatment of the hemiplegia that usually remains, after the attack has been recovered from; fifthly, the measures to be recommended to prevent a recurrence.

1. The first *indication*, of course, in a hæmorrhagic case is, by reducing arterial tension, to prevent, if possible, the further outpouring of blood from the ruptured cerebral vessel or miliary aneurysm. For this purpose the patient should be kept as completely at rest as possible; and all movement or disturbance of the body should be forbidden. When it is practicable, he should not be moved from the place in which he has fallen, or only on to a mattress or bed; the shoulders and neck should be raised, but care should be taken not to put a pillow under the back of the head so as to throw the chin down on the chest, as in that position the pharynx becomes obstructed by the tongue, and stertorous (obstructed) breathing is produced. To avoid this stertorous or obstructed breathing, it has been suggested that the patient should be turned on to the side opposite to the seat of the lesion, and sometimes it may be needful to draw the tongue out of the way by forceps; but we consider even this amount of

movement should, if possible. be avoided ; and we have observed the noisy dyspnœa disappear on the removal of the pillow, which is generally placed under the head, and which, as we have said, throws the chin down on to the chest. All pressure round the neck and all tight clothes must be removed; and it is often necessary, in order to avoid disturbance of the patient, to cut them away. When the coma is very profound, and the paralysis general, the case must be regarded as hopeless; and the exhibition of any excessive zeal or meddlesomeness should be avoided, especially when the patient is advanced in years, as will most frequently be the case. If, however, the case has not this altogether hopeless aspect, and the patient is not very advanced in years, the question of more active interference must be considered. Shall we, or shall we not, bleed the patient? In the case of an old and feeble person, we may at once decide not to do so; and in younger persons, if there should be any grounds for believing that the apoplectic attack may be caused by cerebral anæmia and softening from embolism, or thrombosis, we should also put aside the idea of the removal of blood as only likely to do harm. If, again, there are signs of cardiac debility, and a pulse of low tension, we should not think of bleeding.

If, however, in a still vigorous man, we find a full, hard pulse of high tension, a hypertrophied left ventricle, a flushed face, pulsating carotids, and an accentuated aortic second sound, then it can hardly be wrong to open a vein in the arm and let out a full stream of blood, so as rapidly to reduce the arterial tension, and favour the cessation of the hæmorrhage into the brain, by promoting the formation of a coagulum at the bleeding point. The older physicians tell us that patients, when bled, used to emerge from their apoplectic coma as the blood was flowing; and there seems no good reason for doubting this, as we may suppose they frequently had to deal with such cases as we have just described.

Fagge, who is, on the whole, averse from bleeding, points out, however, that, in cases "in which the symptoms of cerebral hæmorrhage are slowly ingravescent," not only should the patient be kept absolutely still, and the administration of brandy, and even ammonia, strictly forbidden, the limbs being kept warm by friction with hot flannels, but "as reaction comes on, the question of blood-letting must be most seriously weighed . . . it is possible that free venesection, just at the time when the vigour of the circulation is being re-established, may, by lowering the pressure in the cerebral vessels, prevent further effusion of blood." *

There is, however, another method of lowering arterial tension, and of relieving cerebral hyperæmia, which is almost universally adopted, and that is the administration of a strong purgative. Five to 10 grains of calomel are thrown on the tongue, or a drop or two of croton oil, mixed with 4 or 5 drops of glycerine or olive oil, may be dropped into the mouth. But this even we should not do in old, debilitated persons, with a weak heart and a feeble pulse. If the bowels are loaded, in such cases it is best to clear them out by means of an enema of olive oil and turpentine, mixed with warm soap and water. An ice-bag should be applied to the head on the side of the lesion, and hot-water bottles to the feet. The hot bottles must be well protected, owing to the tendency, in these cases, to the formation of blisters and sloughs. The inclination on the part of anxious friends to feed the patient by the mouth, when he is really unable to swallow, must be restrained; and they should be informed of the danger of the passage of food and drink into the air passages; and that no harm can arise from abstention from food for a day or two. There is no objection to rectal feeding, if the general condition of the patient points to the need of nourishment or stimulant. If the mouth is dry it may be moistened with a feather dipped in glycerine and

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* "Principles and Practice of Medicine," vol. i., p. 595.

water, having some mild antiseptic (boric acid) in solution.

The evacuation of the bladder must be seen to, and the catheter used regularly so long as the patient remains comatose; and the bed should be examined, to see that it is smooth and even, and that there is no undue pressure or friction of the skin of the back, as bed sores are very readily established in these cases. A water mattress is advisable when it can be procured, but the transference of the patient should be postponed until the fear of exciting fresh hæmorrhage has passed away. The patient's bedroom must be kept quiet and darkened.

2. During the period of febrile reaction it is important to keep up the application of ice to the head, to purge freely, and to avoid giving stimulants.

We do not see any likelihood of ordinary hæmostatics, such as acetate of lead, gallic acid, or ergot, being of use in arresting cerebral hæmorrhage, more especially as the patient is usually unable to swallow; and it is difficult to know whether the hypodermic injection of ergotin would do harm or good; so far as it tends to raise arterial tension by causing contraction of the arterioles generally, it would seem likely to do harm; whereas, on the other hand, by causing contraction of the bleeding vessel, or the trunk from which it proceeds, it might favour the arrest of the hæmorrhage; it must, however, be borne in mind that it cannot act on the walls of diseased arteries as it does on healthy ones. It might, perhaps, be worth trying in ingravescent cases, as they are generally fatal as at present managed. The administration of calcium salts is admissible in the cases in which the bleeding is slow and recurrent.

When the apoplectic attack is due to softening from embolism or thrombosis, there is little to be done by treatment beyond keeping the patient absolutely still and quiet. Bleeding is counter-indicated, as it lowers tension, favours coagulation, and tends, therefore, still further to depress the nutrition of the brain substances. Free purgation is also to be avoided, and a gentle aperient action only should be sought for. Should there be irregularity and feebleness of the heart's action, stimulants, such as ether and ammonia, may be given, and some recommend small doses of digitalis.

In thrombosis from syphilitic arteritis (which is met with usually in males between 20 and 40 years of age, and which may cause hemiplegia without loss of consciousness), anti-syphilitic medication must be vigorously applied; 20 to 30 grains of potassium iodide must be given three times a day, and mercurial inunctions freely used.

Embolic cases associated with cardio-vascular disease are not always attended by apoplexy. *Hemiplegia* may occur without loss of consciousness, and in such cases the patient should for a time be confined to bed and kept on a simple but nutritious diet, and if the area of softening is limited and its situation comparatively unimportant, complete or partial recovery may be established.

3. On the recovery of consciousness after an apoplectic seizure, the patient requires the greatest possible care and cautious management, in order to avoid a recurrence of hæmorrhage and to favour the subsidence of the cerebral inflammation and irritation excited around the clot. The diet must be very light and unstimulating, and consist of milk and farinaceous foods chiefly. Cold applications to the head must still be maintained, free action of the bowels must be kept up, and benefit is sometimes obtained from the derivative action of mustard plasters or blisters to the nape of the neck. Some give small doses of aconite with potassium bromide at this time, and later on the bromide combined with iodide, with the view of promoting the absorption of the extravasated blood.

4. The treatment of the **hemiplegia** and of the rigidity and contracture of the muscles which follow the apoplectic attack is of some importance, our

object being to guard against late rigidity, articular adhesion, and muscular atrophy. Early systematic treatment may effect much in these directions.

Articular adhesions, which are perhaps the most serious of the troubles to be prevented, may be obviated by the early application of gentle passive movements, several times a day, to the joints involved.

The spasticity or early rigidity of muscles must also not be neglected, lest it pass into late or permanent rigidity. We should therefore seek to correct all faulty and abnormal positions which the limbs may tend to assume. A sand-bag in the axilla will prevent adduction of the shoulder. The elbow should be kept extended rather than flexed. The same principle should be applied to the lower limbs. The contraction of muscles may be counteracted by efforts to improve the nutrition of their weaker antagonists. The use of sand-bags will be of value to maintain favourable positions for the limbs, and the interest of the patient himself may be aroused in assisting, by means of the sound limbs, in righting these deforming tendencies. It is most important that he should be encouraged to attempt and repeat all movements of which he is capable in the paretic extremities.

Muscular atrophy is rarely marked and can be remedied by passive movements, gentle massage, and electricity. We should massage only the weaker muscles, and the massage should be skilfully directed by the medical attendant, if not actually applied by him. Faradism and galvanism are useful adjuncts to massage, but they cannot take its place. Strong currents must not be used. They should not be so strong as to cause pain, but sufficiently powerful to cause muscular contraction. In favourable cases we should attempt to re-educate and amplify the muscular movements. This will require a good deal of patient endeavour on the part both of the doctor and of the patient.

As improvement proceeds, *exercises* and *mechanotherapeutics* may be employed to increase power already to some extent regained. Such measures may also be of value in remedying inco-ordination and weakness of the limbs.*

The diet during convalescence must be light and nutritious, but not exciting. It is best to avoid animal food, or at any rate to limit it to a little chicken or fish. No alcoholic drinks, save for exceptional reasons, should be permitted, and strong tea and coffee are best avoided. But the digestive peculiarities of each patient must be studied, and no attempt made to carry out a hard-and-fast rule as to diet. A strictly vegetarian diet, with milk, has been advocated, and this, where it agrees well, is sound advice; but where, from individual peculiarities, this is not the case, it is worse than useless to insist on such a strict regimen. General tonic treatment may be needed, as in convalescence from other illnesses, but in those cases it should be attempted with great caution and care, lest any cerebral irritation be re-excited. The bowels must be specially attended to, and regular daily evacuations secured. All brain-work must of course be forbidden, and everything that can excite the emotions or irritate the temper—and such patients are apt to display periods of irritability—must be kept at a distance. If the patient is restless at night and sleepless, it may be necessary to give some bromide at bed-time, with which a little henbane may, if necessary, be combined.

When the hemiplegia has become chronic, and especially when contractures have developed, there is perhaps little use in submitting the patient to any further electrical or other treatment. But many well-to-do patients do not readily reconcile themselves to this "masterly inactivity," and it is in such instances that a course of baths, combined with electrical treatment and massage, at such thermal stations as Gastein, Ragatz, Wildbad, or Teplitz may be occasionally recommended. Such courses cannot cure or remedy what is incurable and irremediable, but they induce an effort to lead an out-of-door life and to be much in the health-restoring open air of those pleasant resorts, and it has been often observed that both cerebral and spinal paralyses do improve in such places, after treatment therein.

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* A very full and instructive paper on the treatment of hemiplegia, by Dr. Guthrie, will be found in the *Lancet*, vol. ii., 1901, p. 1035.

5. Finally, we have to consider what are the best rules to enforce on such persons as have had an apoplectic seizure, or are known to be predisposed to one, in order to **prevent** an attack or a recurrence. We have elsewhere pointed out the kind of diet best suited to such patients—white meats, green vegetables, and ripe fruits, and the avoidance of butcher's meat, fats, and saccharine substances—and, above all, *great moderation* in eating and drinking should be enforced. As the bowels are likely to be sluggish, a daily laxative is advisable, as all straining at stool is particularly to be avoided. All kinds of emotional excitement, and especially attempts at sexual intercourse, must be strictly forbidden. Gentle and regular exercise in the open air, stopping short of fatigue, is advantageous. The functions of the skin should be promoted by warm baths and friction. If the patient should be gouty, a mild course of alkaline saline mineral waters may occasionally be useful, but these may be taken at home, and need not involve the trouble of a visit to a Continental spa.

In short, free elimination by all the excreting organs should be promoted. Co-existing renal, cardiac, or arterial disease must be treated on the general principles already laid down in former chapters. The object of preventive treatment is, it should be remembered, to diminish the tendency to high arterial blood pressure, and to avoid putting any strain on degenerated blood-vessels.

When hemiplegia has resulted from syphilitie thrombosis it is all-important that the patient should realise the necessity of undergoing further courses of antisyphilitic treatment at intervals of a few months for some years after his attack. It is only by following this advice that freedom from recurrences can be ensured. It is our practice to give such cases two or three grains of grey powder daily for three weeks, sometimes followed by a course of potassium iodide three or four times a year; other methods of mercurial treatment are equally efficacious.

Certain surgical measures have been advocated in the treatment of cerebral hæmorrhage, but they can hardly be said to have been found of value clinically. We are living in an age especially characterised by surgical interference and activity—an age which will probably be known in the future history of medical science as "the surgical age." It is not then surprising that somewhat bold proposals should have emanated from enterprising surgical minds in connection with the treatment of apoplexy. We refer especially to ligaturing or compressing the carotids for the purpose of arresting cerebral hæmorrhage, and to trephining the skull for the removal of a blood-clot, or a hæmorrhagic effusion in the substance of the brain, or in the ventricles. Until the value of such measures has been practically demonstrated by distinctly improved clinical results we shall refrain from advising their adoption.

INTRACRANIAL TUMOUR

Although tumours of the brain, like tumours in other situations, must always be regarded as among the gravest of ills to which man is heir, yet their occurrence affords medical men opportunities of displaying wisdom in diagnosis and judgment in treatment with results often gratifying to patients and their friends. There is no position in which a judicious physician, who can enlist the services of a skilled but conservative surgeon, can accomplish more in the way of cure, of prolonging life or of alleviating great distress, than when facing what at first sight appears to be the hopeless problem of an intracranial tumour.

The space at our disposal, as well as the restricted scope of this work, forbids our entering upon anything but the briefest notice of the clinical features of these cases, which need the most elaborate investigations in the attempt at localisation of lesions; an attempt which, from the extreme difficulty of the subject, sometimes fails even when undertaken by the most experienced neurologists.

The brain seems to be a favourite seat for the development of neoplasms. The most common forms are glioma, gliosarcoma, sarcoma, endothelioma, tubercle and gumma Carcinoma is much more rare. Many other forms, including parasitic and other cysts (hydatids, cysticercus, dermoids, etc.) occur, but with much less frequency, and offer few special points of interest in connection with treatment.

The predilection displayed by particular forms of growth for particular situations, and the special liability of certain regions to the development of neoplasms in general, are hardly sufficiently striking or universal to afford knowledge of practical value when dealing with individual cases. We may call attention, however, to the frequency with which gliomata, fibromata or fibro-sarcomata arise in the ponto-cerebellar angle in connection with the eighth nerve, to the common occurrence of glioma and tubercle in the pons and cerebellum, especially in young subjects, to the superficial site of most endotheliomata and gummata, and to the preponderance of gliomata in the substance of the adult hemispheres. No hard-and-fast rule can be laid down about the rate of growth of the different varieties.

Glioma and sarcoma generally develop singly; the former is always primary, the latter sometimes secondary and metastatic. Carcinoma is probably always metastatic and often multiple. Tubercle and syphiloma are also frequently multiple.

There is little to be said with regard to the *etiology* of these growths and nothing which is not equally applicable to neoplasms or granulomata of other parts. Secondary intracranial tumours often follow primary growths of the lung.

The **symptoms** of intracranial tumours may be divided into those which are general and those which are focal. The former are perhaps of most importance from the therapeutical point of view, the latter from the localising standpoint, although it must be remembered that an accurate diagnosis of position is often the first step towards successful treatment.

Headache, vomiting, optic neuritis, vertigo, slowing of the pulse and respiration, and convulsions may be regarded as the chief general symptoms, and each deserves separate but brief consideration.

Headache is very frequent; when absent, vomiting and optic neuritis are also wont to fail. It is usually paroxysmal, often very severe and not unfrequently excited or increased by movement. It may be diffuse, but is more commonly localised and associated with tenderness on deep pressure over its site. *Vomiting* occurs independently of meals, although it may be evoked by the ingestion of food; patients often suffer most in the early morning. *Optic neuritis* is not a constant phenomenon, especially with slow-growing tumours in the sub-cortical regions of the hemispheres and in the pons. It is usually early and intense with cerebellar neoplasms. The neuritis in the homolateral eye exceeds or precedes that in the eye of the opposite side in more than half the cases. Temporary amblyopia is occasionally met with in the course of its development. Attacks of *vertigo* are among the general symptoms of intracranial tumour, but they have not the characteristics of the vertigo which is a focal symptom of growths involving the cerebellum. Jacksonian epilepsy is a focal symptom, but general *convulsions* may be present in any case when intracranial pressure is increased. *Slowing of pulse and respiration* denotes increased pressure, and is always a danger signal.

What may be regarded as focal symptoms are too varied and too numerous for consideration in this work, but they must be carefully investigated in all cases before the physician can recommend surgical interference. A suspicion of intracranial neoplasm should always be raised by the *slow* development of a cerebral palsy, of hemiplegic, monoplegic or cranial nerve type, and the supervention of optic neuritis be carefully and repeatedly looked for in all such cases.

The **course** of cerebral tumour is progressive, although the duration may be long; latency is especially frequent in cases of tubercle.

The **prognosis** is always grave, but less so when a syphilitic origin for the disease can be determined. Sudden death from respiratory failure is a common termination.

The **treatment** of cases of intracranial tumour will vary with the site, nature and symptoms of each growth, but a few general principles may be laid down with advantage. When the localisation of the growth is possible and has been made, the question of its possible syphilitic origin must first be answered. If there is any suspicion of this source for the morbid process, antisyphilitic treatment must be at once instituted. Iodide of potassium should be given by the mouth in doses of 10, rapidly increased to 25 or 30, grains, three times daily. At the same time a dram of mercurial ointment should be rubbed into the skin every day until slight salivation is evoked. Special attention to the cleanliness of the mouth should be paid during the mercurial treatment, whether the latter is carried out by inunction or by the internal administration of soluble salts, such as the perchloride. Amelioration of symptoms ought to be evident in the course of a week or two, but the treatment may be pushed for a longer time, even without favourable signs, provided loss of sight or other permanent harm is not threatened. It should be remembered that a patient who has a cerebral tumour of any kind, when put to bed and given large doses of iodides, is likely to suffer from less headache and vomiting owing to the lowering of the blood pressure. A more delicate gauge of the efficiency of the treatment can be derived from watching the progress of the optic neuritis. If the latter increases in intensity after a fortnight's energetic administration of iodide and mercury, it is safe to assume that we are not dealing with a gummatous process.

Having excluded the luetic nature of the growth the question of its removal must next be considered. This may or may not be deemed possible or advisable. If there is any hope of enucleation an operation should be undertaken with the object of clearing up doubt. It is at this stage that judicious handling of the case is most required. An unsuccessful attempt to remove a tumour may easily place the patient in a worse plight than before, a result which must at all costs be avoided. This is especially the case when the growth involves parts in the neighbourhood of the motor and speech centres, where the risk is run of making the patient hemiplegic or aphasic or both. The discovery that complete or almost complete enucleation of the tumour is impossible should be sufficient to check the surgeon from further interference and make him content with the almost certain alleviation of headache, vomiting and defective vision which will result from opening the skull and relieving pressure.

A radical cure is only possible in a small proportion of cases, but cerebral surgery of a conservative kind is most valuable in less favourable instances provided the line of action above indicated is adhered to. We have even observed all symptoms of cerebral growth disappear after the skull has been opened, although no tumour had been seen at the operation.

The cases in which the growth cannot be localised or in which, although localised, it is deemed inadvisable to attempt removal, have next to be dealt with. Headache may be relieved by the administration of iodides, antipyrin, phenacetin, and other analgesic drugs, or local treatment in the form of leeches or ice-bags may be more efficacious. Vomiting is often difficult to control, but small doses of chloretone, chloralose or atropin are sometimes successful. Convulsions may be controlled by the use of bromides, with or without chloral. Unfortunately in many cases these measures, and even the use of morphia, avail little or nothing in the way of relieving distress, and the threatened loss of sight from consecutive optic atrophy compels us to resort to surgical aid for procuring alleviation. The opening of the skull should then be regarded as a palliative measure only and the site for the trephining chosen with that object in view; the right frontal region is a favourite situation when no other is specially indicated.

The employment of lumbar puncture for the removal of cerebro-spinal fluid in order to relieve pressure has not proved of any permanent value, and a fatal result has been recorded in several instances.

It is hardly necessary to add that a patient suffering from intracranial tumour should be kept quiet and at rest, should partake of a light but nutritive diet and, when the later stages of stupor with incontinence of the sphincters supervene, should be carefully nursed with due regard to cleanliness and the prevention of bed-sores.

With regard to the after-treatment of syphilitic patients it is advisable to continue the administration of iodides in smaller doses for several weeks or a few months after the symptoms have cleared up, and to resort to further courses of a similar kind at intervals during some years. Cerebral syphilis is a condition which is specially liable to recur unless prophylactic measures of this nature are persevered with.

ADDITIONAL FORMULÆ

Aperient powders in meningitis

℞ Hydrargyri subchloridi, gr. vijss ad xij.
Pulveris radicis jalapæ, gr. xv ad xx.
Sacchari albi, gr. lxxv.

M. et div. in pulv. vj. A powder every hour.
(*Bamberger.*)

For violent headache in meningitis unrelieved by local bleeding or application of ice

℞ Morphinæ hydrochloridi, gr. $\frac{3}{4}$.
Sacchari albi, gr. lxxv.

M. et div. in pulv. v. One every three hours until a sedative effect is produced.
(*Bamberger.*)

Mixture in meningitis

℞ Potassii iodidi, gr. xv ad xxx.
Aquæ menthæ piperitæ, ʒv.
Aquæ destillatæ ad ℥iij.

M. f. mist. A dessertspoonful three or four times a day.
(*Henoch.*)

For great depression in meningitis

℞ Camphoræ, gr. vijss.
Emulsionis amygdalæ, ℥j.

M. Half to be given by the rectum. (*Bamberger.*)

For convulsions in tubercular meningitis

℞ Chloral hydrate, gr. vijss ad xv.
Decocti althææ, ℥iij.

M. Half to be given by the rectum. (*Widerhofer.*)

For syphilitic thrombosis or gumma

℞ Hydrargyri perchloridi, gr. j.
Potassii iodidi, ʒiii ad ℥i.
Glycerini, ℥j.
Aquæ destillatæ ad ℥viij.

M. f. mist. A tablespoonful thrice a day immediately after meals.

Hæmostatic in cerebral hæmorrhage

℞ Extracti ergoti fluidi, ʒj.
Glycerini, ♏xxx.
Aquæ ad ℥j.

M. f. haustus. Every three hours. (*Bruce.*)

In paralytic stage after cerebral thrombosis

℞ Ferri et quininæ citratis, ʒijs.
Tincturæ nucis vomicæ, ʒijs.
Glycerini, ℥i.
Infusi calumbæ ad ℥viii.

M. f. mist. A tablespoonful three times a day after meals.
(*Bruce.*)

CHAPTER II

TREATMENT OF DISEASES OF THE SPINAL CORD

TABES OR LOCOMOTOR ATAXY (Sclerosis of Posterior Columns).—Characters, Symptoms, and Course—Causation—Relation to Syphilis—Antisyphilitic Remedies—Arsenic—Atoxyl—Nitrate of Silver—Gold Salts—Ergot—*General Management*—Treatment of Pains, Gastric, Rectal and Laryngeal Crises—Treatment of Bladder Symptoms and Ataxy, of Optic Atrophy, etc.—Suspension—Hydrotherapy—Electricity.

ACUTE POLIOMYELITIS (Infantile Paralysis).—Nature, Course and Symptoms—Treatment of Acute Stage—Antipyretics—Analgesics—Rest—Treatment in later Stage—Strychnine—Exercises—Massage—Electricity—Orthopædic Appliances—Nerve and Tendon Grafting.

PARAPLEGIA and the Morbid Conditions associated with it.—Variety of Causes—Myelitis, infective and syphilitic—Hæmatomyelia—Disseminated Sclerosis—Combined Scleroses—Syringomyelia—*Compression Paraplegia*—Fracture Dislocation—Spinal Caries—Spinal Tumours—*Symptomatic Treatment*—Sphincter Troubles—Prevention of Bed-sores—Spastic Paralysis and Flexor Spasms—Flaccid Paralysis—General Management—Caisson Disease.

PROGRESSIVE MUSCULAR ATROPHY, etc.
Additional Formulæ.

IT has been said that the treatment of "diseases of the spinal cord is one of the darkest chapters in therapeutics," a remark which betrays some want of discrimination in its author. If it is true that we are unable to restore to their normal condition parts of the spinal cord which have undergone structural changes as the result of morbid processes, it is equally true that our powers are limited in a similar way when faced by structural alterations in almost any other organ of the body. Renal, hepatic and pulmonary cirrhosis are no more amenable to curative measures than are the various scleroses of the cord; pneumonia, pericarditis and enteric fever are more fatal diseases than poliomyelitis and probably as little influenced directly by any remedial agents at our command

On the other hand, disorders of spinal function respond to judicious treatment as do the functional disorders of other tissues, and the clear knowledge we have gained of the difference between functional and organic affections of the nervous system compares favourably with our insight into the same question when applied to other viscera. It may be said that some spinal diseases are hopelessly progressive, but so are most cases of arterio-sclerosis, of pernicious anæmia, of diabetes, and even of such a vulgar complaint as chronic bronchitis and emphysema. Diseases of the spinal cord are, in fact, characterised by their disabling results, but not by any special lack of response to appropriate remedies. We may go further and say that the spinal marrow shows great powers of recuperation and remarkable possibilities in the way of re-education of function.

TABES DORSALIS, or LOCOMOTOR ATAXIA
(*Posterior Sclerosis*)

This disease, named by Duchenne "progressive locomotor ataxy," has also been termed "posterior sclerosis" because its main anatomical feature consists in degenerative changes in the posterior spinal columns and in the posterior spinal roots. Clinically it is characterised by a number of **symptoms**, most of which are referable to disorders of function in the afferent or sensory system of the nervous system. Thus the chief phenomena, following a common order of frequency and occurrence, are pains, paræsthesiæ, blunting of deep, cutaneous and special sensibility, loss of reflexes, disturbances of sphincter control and sexual power, incoordination, trophic changes, and more rarely true motor paralysis.

Characteristic tabetic *pains*, usually called "rheumatic" or "neuralgic" by hospital patients, being quite unlike either, are sharp, flash-like, quickly repeated but paroxysmal. They may occur in any part of the body and are often more noticeable in wet, inclement weather than when the atmosphere is warm and dry. The intensity of suffering varies greatly in different patients and in the same patient at different periods, but "lightning pains" are capable of making life intolerable in their more severe form. Deep pains in the back or limbs of a more continuous aching or boring character are also often complained of. Sharp "niggling" pains darting from one place to another are frequently the first sign of commencing tabes.

Paræsthesiæ in the form of numbness, "a velvety feeling" or formication are common, and *diminution of various forms of sensibility* occur quite early. Of the latter the loss of pain on deep pressure of muscles often accompanies cutaneous analgesia and anæsthesia. The skin of the legs and of the root areas corresponding to the upper three or four dorsal segments are generally the first to exhibit modifications of sensibility. Loss of visual acuity associated with *optic atrophy* is a common symptom and may occur early or late. In the former case it seems to check the progress of other symptoms, probably by the general inactivity it inevitably ensures. Loss of tendon reflexes follows the distribution of the other symptoms, and is therefore often found in relation to the patellar and Achilles jerks in the early stages and with most other muscles later. Hypotonia of the same muscles is usually present and may reach a high degree of intensity. The characteristic *inactivity of the pupils* to light, while retaining their mobility to accommodation, constituting the "Argyll-Robertson pupil," may be mentioned here as one of the most constant signs of tabes. Constipation, hesitancy, and later retention, of micturition, form the ordinary *sphincter* troubles, and early diminution of sexual power is equally frequent. Charcot's arthropathies are well-known instances of *trophic disorders* in locomotor ataxy and, although usually one of the later phenomena, may, in some cases, first draw the attention of the patient or his medical adviser to the existence of spinal disease. Intractable perforating ulcers of the feet demonstrate the poverty of healing power.

The *incoordination* which produces the ataxic gait in some patients results from the rapid loss of certain afferent impulses which, in the normal person, serve to regulate harmoniously the motor activities; but it is only a minority of tabetic sufferers who display this symptom in a marked degree when they first come under observation, and many may escape altogether the staggering form of locomotion so often put forward as the chief characteristic of the disease.

Various "*crises*" belong to the symptomatology of tabes dorsalis, and of these the gastric examples are the most common. They consist in very severe attacks of gastric pain, attended often by vomiting of very acid fluid, attacks which are not necessarily associated with food. Rectal crises or bouts of painful tenesmus are similar though less common symptoms. The laryngeal crises differ from the others in that they are essentially motor in origin and depend upon a palsy of the abductors together with a spasm of the adductors of the larynx. Other examples of *motor paralysis* are afforded by the ophthalmoplegiæ which are quite of ordinary occurrence, and more frequent than true palsies of any other muscles of the body.

Though rarely or never cured, tabes is a disease which runs an irregular **course** and may be favourably influenced by treatment and surroundings. Long stationary periods are commonly observed, but, unfortunately, acute exacerbations cannot always be avoided. Some so-called "acute" cases run a rapid course from the first, and other cases are so intimately combined with General Paralysis tabo-paralysis—that their duration is not protracted. The disease is rarely fatal of itself; some intercurrent malady in the bed ridden stages, or some complication in the way of cystitis or decubitus is usually responsible for the patient's death.

The first and foremost **cause** of tabes is syphilis, a history of which can be obtained in at least 80 or 90 per cent. of cases. No statistics are infallible, wherefore it is impossible to say whether the disease can arise independently of this cause. Other contributory agents are over-exertion and strain, mental and physical, venereal excesses, traumatic and hereditary influences.

We must be content with the foregoing brief reference to the nature and causation of this interesting disease, as an introduction to a consideration of its **treatment.** The *indications* are to arrest, if possible, the progress of the disease; and to relieve the painful and distressing symptoms. In estimating the value of any mode of treatment in this disease we must bear in mind its natural tendency to slowness of progress, to quite long stationary periods, and to the frequent spontaneous remission, or even disappearance, of certain symptoms.

The propriety of submitting the patient to vigorous *antisyphilitic* treatment is the first question to be considered, as this alone, in the majority of cases, responds to the causal indication. In many cases it will, of course, fail, because, even when due to syphilis, most cases come under treatment too late to effect a cure, although the progress of the disease may be retarded. In the later stages of the disease it is not calculated to be of so much service as it is in the earlier.

Antisyphilitic treatment, however, affords a chance which should never be overlooked in treating a case of tabes, and the earlier we have the opportunity of applying it the better are the results we may expect. Potassium iodide often proves a valuable remedy, even in cases where there is no discoverable syphilitic taint. It seems to exert a remedial effect on the lightning pains. Osler thinks that it is only when the syphilis has been of recent date—when the symptoms develop within two years of the primary affection—that there is a possibility of arrest by mercury and potassium iodide.

Oppenheim states that "personally" he has never seen any good results from antisyphilitic remedies, but he considers mercury should be used when "there is a positive history of syphilis, or in which we find syphilitic symptoms," or when former antisyphilitic treatment was incomplete, or when the possibility of syphilis of the spinal cord cannot be excluded.*

The antisyphilitic treatment should be carried out in the following manner:—About $\frac{1}{2}$ a drachm of mercurial ointment, mixed with an equal part of lanoline, should be rubbed in daily into the inside of the thighs, or in the axillary regions, or over the abdomen; the part of the surface selected having been previously washed with warm water and soap, and then with alcohol. About half an hour should be devoted to the inunctions, and a flannel bandage should be firmly applied afterwards to promote the complete absorption of the drug. The effect is promoted by a warm bath (87° to 90°) for fifteen minutes daily before the inunction. Salivation must be avoided. When there are difficulties in carrying out this plan, the advantage of which is that it does not disturb the digestive functions, mercury must be given internally. The perchloride, in doses of $\frac{1}{48}$ to $\frac{1}{32}$ grain, or the red iodide, in doses of $\frac{1}{12}$ to $\frac{1}{6}$ grain in a pill, may be given thrice daily. At the same time, potassium iodide should be given in gradually increasing doses, from 10 to 60 grains three times a day, in 2 ounces of some bitter infusion an hour before meals. The larger doses should not be continued for more than three or four weeks at a time, but smaller doses may be given for two or three months longer.

This mode of treatment, or any modification of it, whether followed by decided improvement or not, should be repeated for two or three weeks at a time, at intervals of three or four months.

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* "Diseases of Nervous System," p. 140.

Apart from antisyphilitic treatment, the drugs that have received the greatest amount of commendation are arsenic, nitrate of silver, and corrosive sublimate. *Arsenic*, as one of the best nerve tonics, may possibly retard the disintegration of nerve-fibres in the sclerotic areas of the cord; $\frac{1}{40}$ grain of arsenious acid should be given three times a day, or hypodermic injections of atoxyl, one half to two grains, may be administered daily between the courses of mercurial treatment. *Corrosive sublimate* is believed to retard the progress of connective-tissue inflammations; $\frac{1}{50}$ grain may be given thrice daily.

The use of *nitrate of silver* was at one time widely advocated as having produced great improvement in many cases. It is given in doses of $\frac{1}{4}$ grain three times a day. It is best administered made into a pill with unguentum kaolin. It has been found to allay the attacks of pain and lessen the liability to them. A great drawback to the employment of this drug is that not only does it tend, after long use, to produce a blue discoloration of the skin, but it is also very apt to cause gastric disturbance. To avoid the latter, it has been suggested that larger doses of *oxide* of silver answer as well and do not produce this effect. Any appearance of discoloration of the skin should lead to the discontinuance of the drug.

Ortho-phosphate of silver has also been given in increasing doses with good effect; it is said not to discolour the skin.

As a substitute for nitrate of silver, over which it certainly possesses the advantage of causing no staining of the skin, the double *chloride of gold and sodium* has been used and praised by many writers. Its use is said to cause absorption or atrophy of morbid connective-tissue formations. It is given in doses of $\frac{1}{30}$ to $\frac{1}{12}$ grain in pills three times a day. Charcot advocated the administration of *ergot* or *ergotine*, not continuously, but for four days in every week. Its use has been attended in early cases with temporary improvement. Church thinks it has a beneficial effect on the bladder symptoms.*

Although various drugs have enjoyed from time to time a reputation for effecting some change in the progress of locomotor ataxy, the antisyphilitic treatment is the only one which we can recommend with any degree of confidence. Nor do we hold with the statement usually made that it is contra-indicated in cases complicated by the presence of optic atrophy.

Before discussing the symptomatic treatment of the disease, some indications as to the *general management* of tabetic cases must be given.

In the first place it is open to the more well-to-do patients to combine the mercurial treatment with a course of baths, fresh air and mild recreation at a foreign watering-place such as Aix-la-Chapelle. With the same class the avoidance of an English winter by a sojourn in Egypt or Northern Africa, Madeira or the West Indies, will probably be attended by benefit, or at any rate by a reduction in the severity of the lightning pains, which appear to be so easily influenced by climatic conditions.

Speaking generally, the patient should be advised, while avoiding any excessive mental or physical strain, to continue so far as possible his ordinary pursuits and interests, to abstain from alcohol and be moderate in the use of tobacco, to refrain from sexual excess and, being single, not to marry. Attention to general nutrition is most important, the tendency to progressive loss of weight in the early stages of tabes being marked. A generous diet, to which cod-liver oil is a useful adjunct, is indicated, and this may be combined with general massage in certain cases.

The question of rest is one which demands grave consideration. No tabetic, who is not severely ataxic, should be lightly told to go to bed for a week or two unless some urgent reason, such as the presence of acute cystitis or other forms of sepsis, demands this course. A period of rest may leave the patient far more ataxic than he was before owing to cessation of the unconscious re-education of movements, which continues so long as he is getting about. On the other hand, a patient may become so ataxic that bed is the only possible place for him, in which case the treatment of the ataxy must be instituted on the lines laid down by Fraenkel, to be referred to later.

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* "Nervous and Mental Diseases," p. 420.

The *pains* of tabes may be controlled by the administration of such drugs as antipyrin, phenacetin, exalgin, aspirin, cannabis indica, pyramidon and antifebrin, but it is necessary to ring the changes on this group by the frequent substitution of one member for another as each loses its efficiency. Osler advises the prolonged use of nitro-glycerine in increasing doses when high arterial tension is present. Gowers finds that aluminium chloride in doses of two to four grains three times a day diminishes the severity of the pains. Salicylate of soda or colchicum, together with potassium iodide or ammonium chloride, is commended by Risien Russell. Unfortunately there are cases in which none of the drugs mentioned succeed in dulling the sufferings of the patient, and the desire for the more potent aid of morphia or cocaine becomes urgent. Although all rules must occasionally be broken, it ought nevertheless to be an axiom that morphia should never be given for tabetic pains or for the gastric crises. However severe may be the physical suffering, it is nothing compared to the miserable condition to which the sufferer from locomotor ataxy, who has become dependent upon morphia, is reduced. We have seen examples of the truth of this statement in those who have reached the lowest depths of moral degradation from the use of morphia for the painful manifestations of this disease. The recollection that lightning pains may have to be dealt with over thirty or forty years, and that they are spontaneously inclined to vary in intensity and frequency from time to time, should prevent the medical man from inaugurating a step which sooner or later so often leads to morphomania.

Gastric crises are often the greatest terror to be faced by the patient and not unfrequently prove the most intractable to the physician. Disorders of digestion must be attended to on ordinary lines, and small doses of extract of opium or of Battley's solution, taken when the stomach is empty, twice or three times a day, may be useful. Cerium oxalate will sometimes relieve the vomiting. We have obtained very good results from the use of chloretone, in cachets containing ten grains each, given at night and in the early morning. Equally efficient in other cases has been the employment of tinctura iodi; one drop in a teaspoonful of water may be taken every hour until the paroxysm has abated.

Rectal crises are often relieved by small doses of mercury and opium combined. A grain of grey powder with a few grains of Dover's powder may be given once or twice daily with good effect. Great care should be taken that the bowels are completely relieved each day by some simple aperient such as the confection of senna, one or two cascara tabloids or the compound liquorice powder; if these fail an enema of tepid water or salt and water may be employed.

Laryngeal crises may be relieved by the inhalation of nitrite of amyl, or by painting the vocal cords with a weak solution of cocaine. A few whiffs of chloroform can be tried, but in the majority of cases the attacks are of short duration and pass off of themselves.

Disturbances of the *bladder* are so frequent and the tendency to cystitis so pronounced, that the care of this organ is of paramount importance. There are those who advocate an early resort to catheterisation and those who postpone the use of the catheter until all other methods fail. Difficulty in micturition may often be overcome by the administration of 5 minims of liquor strychninae thrice daily and by insisting that the patient should make the attempt to empty the bladder, regardless of call, every two or three hours with punctilious regularity. Gentle pressure on the abdomen should be exerted at the same time. In severe cases, where there is reason to believe that the amount of residual urine is excessive and atony of the bladder wall is threatened, periodic catheterisation with strict antiseptic precautions becomes a necessity. When this mode of treatment is established, it is often advisable to give the patient daily from 5 to 15 grains of urotropin by the mouth as a prophylactic measure. If cystitis supervenes, irrigation of the bladder with a weak boric or other antiseptic solution must be carried out every day until the urine becomes normal.

Incontinence of urine which does not depend on the overflowing of the distended viscus will often be mitigated or relieved by 5-minim doses of tincture of belladonna every six or eight hours.

The only treatment of *ataxia* depends on the re-education of the patient to perform movements without the aid of certain afferent impulses which he normally receives through the posterior spinal roots or posterior columns of the cord. With a patient in whom the morbid process is slowly progressive and in whom the necessity of getting about is a constant stimulus to overcome the tendency to stagger and loss of balance, the re-education is naturally and spontaneously going on. When, on the other hand, an acute exacerbation of the disease or a prolonged stay in bed leaves the patient with extreme incoordination, it is necessary to carry out a system of re-education upon definite lines. Fraenkel has introduced such a system, one which requires a skilled teacher, as well as a persevering and intelligent patient, for its success. If the sufferer is so ataxic that he is confined to bed, a simple apparatus can be devised by the physician and made by any carpenter, which will give him an object and goal for the carrying out of simple movements: a plain board, covered with baize, in which a number of holes are cut, is placed on the bed, and the patient is directed to put the heel of one foot in one hole after another, using his vision for the proper execution of the act. These and similar methods, such as an attempt to walk along lines marked out on the floor, taking steps of certain length, should always be undertaken in the presence of the physician or an intelligent attendant, and should be practised for prescribed periods with conscientious care. Ataxy of the hands suggests a number of devices with the same object in view; the playing of draughts or solitaire, the piling up of small objects one upon another, and many other suitable exercises will, in the majority of cases, be attended by most encouraging results. We have seen a patient, unable previously to hold a pen, after three or four weeks of this treatment, write with a creditable hand. For further details the reader is referred to Fraenkel's book on the treatment of tabetic ataxia. This method is not available when vision is seriously affected, but marked optic atrophy is rarely associated with much ataxia. Severe cystitis and arthropathies in their acute stage contra-indicate the exertion necessitated by these exercises.

So far as is known there is no remedy which has any certain influence on the *optic atrophy* or the *ocular palsies* of tabes, and the use of strychnine, though supported by some authorities, has never been proved to avail anything. It is difficult to understand, indeed, how this drug can have any but an injurious effect upon the degenerating visual path if it stimulates the flagging neurones. The ocular palsies are often so transient that it is impossible to estimate accurately the results of treatment, although the galvanic current has been claimed to be worthy of trial.

Arthropathies, fractures and ulcers must be subjected to surgical or orthopaedic measures of a conservative kind, the poor healing properties of the various tissues in this disease being duly remembered. Avoidance of trivial injuries, from the prophylactic point of view, is one of the chief essentials in this connection.

In conclusion, a few words may be devoted to the consideration of other therapeutic measures which have been tried and found wanting, or which depend for their popularity upon the credulity of the public.

Suspension and nerve-stretching belong to "a chapter of medicine of which," according to Möbius, "physicians may well be ashamed," and need only be mentioned to be at once discarded.

Hydrotherapy and electrotherapy, especially as they are practised at the Continental spas, produce their beneficial effects by promoting general nutrition and by suggestion rather than by staying the course of the disease, but will be patronised, at any rate by the rich, so long as the belief in their efficacy endures.

ACUTE POLIOMYELITIS

(*Infantile Spinal Paralysis*)

These names have been applied to an affection of the spinal cord, which occurs usually, but not invariably, within the first five years of life, and was formerly known as "infantile paralysis," or "essential paralysis of infancy." Its true nature as a **myelitis,** affecting chiefly the grey matter of the anterior cornua of the cord, has only been known within comparatively recent times.

This curious disease, the cause of which is not accurately known, but is suspected to be due to an infection by micro-organisms, comes on suddenly, and the paralysis reaches its maximum quickly, even within the space of a day. Its onset is usually attended with some pyrexia, and the temperature rises to from 101° to 103° F. Occasionally, but rarely, the child may be attacked with convulsions. One or more limbs may be found paralysed, the distribution and extent of the paralysis being very variable. Certain groups of muscles, especially in the upper limbs, are liable to be affected together, and the paralysis rarely affects all the muscles of a limb. This is accounted for by the fact that groups of nerve-cells are indiscriminately involved by the inflammatory process at different levels of the spinal cord. The affected limb may not, at any rate at first, show any obvious visible change, but atrophy rapidly sets in, and the muscles become flaccid, soft, and flabby. Generally, after eight or ten days, the "reaction of degeneration" may be detected. The muscles do not react to the faradic current, but respond with a slow contraction to the constant current. For a time the paralysis remains stationary, and then gradual improvement may set in, but complete recovery is exceptional, and permanent paralysis of groups of muscles usually remains. Now that the anatomical conditions of the disease are known, we can hardly expect any other result, for when the large motor cells of the anterior cornua are thoroughly disintegrated, their restoration is impossible. There are no disturbances of sensation, nor are the vesical or rectal functions troubled. A remarkable consequence of this disease, when the paralysis persists, is the extreme wasting of the limb and the arrest or retardation of the growth of the bones. From this and other causes, such as *contracture* of the muscles, serious deformities are apt to arise, such as forms of talipes and shortening of limbs; and, in some instances of paralysis of the deltoid, the head of the humerus falls away from the glenoid cavity.

We have already said that the cause of this disease is unknown, but the chief anatomical condition is a myelitis affecting the anterior cornua, most commonly in the cervical or lumbar enlargements, and leading to atrophy of the anterior cornua and disappearance of the large motor cells in the affected part of the cord. There is also atrophy of the corresponding anterior roots of the spinal nerves, and the wasted muscles undergo slow fatty and sclerotic changes.

It occurs, like an infective disease, at definite seasons and in epidemics, and sometimes develops after other infectious diseases, as measles, scarlet fever, and whooping cough.

This brief account of the nature and symptoms of *acute infantile spinal paralysis* will enable us to enter profitably on the consideration of its treatment.

The **indications for treatment** will depend on whether the child comes under observation at the onset of the acute attack, which is comparatively rare, or when the acute affection of the spinal cord is practically over, which it probably is at the end of a week. In the first case, measures must be adopted to influence, if possible, the acute inflammation in the cord, to lessen its intensity, and limit its extent. In the second case, the chief object of treatment will be to maintain the circulation and nutrition of the paralysed muscles and prevent further wasting. Finally, in advanced stages, mechanical appliances may be needed to prevent or rectify contractures and deformities. If the case is seen during the acute febrile period, antipyretic measures should be adopted and counter-irritation may, if thought desirable, be applied over the affected region of the cord. This will be over the *cervical* enlargement if the paralysis is limited to the upper extremities, and over the *lumbar* enlargement if it is confined to the lower, or over both if both limbs are involved.

To reduce the fever and inflammation, general antipyretics should be given. In strong children a minim of tincture of aconite, with 20 grains of citrate of potash and a little syrup of lemon, in two or three teaspoonfuls of water, may be given every four hours; or aconitine in granules ($\frac{1}{450}$ grain), one every four hours. If this drug does not reduce the pyrexia in twenty-four to forty-eight hours it should be discontinued, and a half-grain or a grain of phenacetin, with a grain of hydrobromate of quinine, mixed with a little lemon-juice and water, given in its stead. In feeble children it is best to begin with the latter. A brisk aperient should be given at starting, such as a grain or two of calomel with 10 to 20 grains of compound jalap powder, and this may be repeated if the bowels become confined.

Sponging the body frequently with a mixture of eau-de-cologne or alcohol and tepid water has also an excellent effect on the fever. It has been recommended to apply an ice-bag to the affected part of the spine if there is an opportunity of doing this at the very outset of the disease, but Oppenheim is opposed to this, and prefers leeching.

During the early days of the disease the patient often suffers from severe pain which is greatly increased by passive movements or interference of any kind. It is wise, therefore, to avoid active measures, and to treat the child just as one would in the acute stage of one of the specific fevers, paying attention to his general comfort, administering a light but nutritious diet, and securing free action of the bowels, kidneys and skin.

If there is much restlessness potassium bromide may be given to soothe and quiet, and should the disease begin with convulsions, 10 to 20 grains of this salt, combined with 5 to 10 grains of chloral, should be administered, dissolved in 2 oz. of water, by enema.

With adults the pain and restlessness may be relieved by a few doses of antipyrin, or even an injection of morphia, if there is no respiratory embarrassment due to paralysis of the intercostal muscles or diaphragm. Catheterisation is sometimes necessary during the first day or two of the illness.

But, too commonly, either the case is not seen until after the acute attack, or the acute attack is misinterpreted. When loss of power in one or more limbs, or muscular groups, has become evident, then careful and long-continued treatment is necessary, in order to maintain nutrition, restore power, and prevent deformities. Of course, if all the motor cells in the cord pertaining to a particular group of muscles are destroyed, then paralysis of that group must remain complete; but if some of the cells remain intact those muscles may regain much, if not all, their power; and, as a matter of fact, we find early and persistent treatment often rewarded by either complete or partial restoration of function in the paralysed groups.

The medicine best adapted to favour the restoration of muscular power is **strychnine,** but as it promotes spinal hyperæmia it must not be given until quite a month after the onset of the attack. Professor Starr recommends that it should be pushed "until slight twitching of the normal muscles, or at least decided increase of the spinal reflexes, is produced." He advises that it should be given for four days in the week for some months, as its intermittent use seems to stimulate the cord more than its continuous use. He adds to the strychnine $\frac{1}{40}$ grain of arsenious acid as a nerve-tonic thrice daily.

But voluntary or passive exercises and electrical stimulation of the muscles are the most important remedial agencies. "By exercise a half-paralysed muscle may be brought up to a point at which it will do an amount of work nearly equal to the normal," and the child should be trained to the use of some simple mechanical contrivance,* by which resistance may be offered to the action of the particular muscles affected, which he should regularly and voluntarily make efforts to overcome. Such exercises should be practised two or three times a day.

Nothing is more useful or more important than regular, thorough, systematic **massage** of the muscles involved, in order to stimulate the circulation in them and promote their nutrition. This may be usefully combined with frictions with warm olive oil or cod-liver oil, and the limb should be kept warm with extra clothing. Gowers says: "The muscles should be daily rubbed and kneaded and gently pinched. The rubbing should be especially upward, so as to expedite the flow of the blood in the veins."

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* These can be constructed at home with a little ingenuity by any intelligent mechanic.

Professor Starr's observations on the application of **electricity** in these cases are so sound and practical that we cannot do better than quote them :—"Electricity applied to the muscles will secure their contraction, and hence will exercise them when voluntary exercise is impossible. At the same time, applied in the form of galvanism, it promotes all those chemical changes in the parts near the poles which are essential to growth. To the muscles which respond to faradism a faradic current should be applied for ten minutes daily. Such response may be obtained in muscles which are only slightly paralysed, and these will recover spontaneously in time, but will regain their power more rapidly under faradic treatment. The muscles which are seriously affected do not, however, respond to faradism, and to these it is necessary to apply an interrupted galvanic current, faradic applications being useless. These muscles respond more vigorously when the positive pole is placed on the muscle; hence that is the pole to be used, the negative being placed on the back. The interruptions should be made by an electrode held in the hand and provided with a finger-key, and each muscle should be treated for about three minutes daily. About one hundred interruptions can be made to the minute by the finger. The strength used should be the least which will secure a contraction in the muscle. When interruptions of the current do not produce a prompt response, alternations of the current may be employed by placing either pole on the muscle and the other on the same limb about a foot away, and reversing the current by means of the pole-charger in the battery. The reversals can be made by the hand at the rate of sixty a minute." *

It must not be overlooked that in this disease electrical applications are unusually painful, and that children are readily frightened by them ; and it is advisable, in order to gain their confidence, at first to apply the sponges and electrodes *without any current*, so as to familiarise the child with the apparatus, and afterwards to begin with exceedingly weak currents, the strength of which can be gradually increased. These applications may be made daily for two or three years, and even longer if the nutrition of the muscle is obviously improving. But if after two years all these measures appear fruitless, it will be useless to continue them. We agree with Starr that the application of the electrical current to the spinal cord is without any effect on the pathological changes present there.

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 681.

For the avoidance of deformities the use and application of suitable apparatus must be made the subject of careful study in each case, and it is best, when practicable, that such apparatus should be designed and constructed with the co-operation of a skilful orthopædic surgeon.

Two important points must be remembered in choosing an apparatus. It must be as light as possible, and it must allow for changes in size and length with the growth of the child.

The operative measures, apart from tenotomies, advocated at the present day by some surgeons, are still on their trial. We have seen no good results from muscle-grafting, but the judicious transplantation of a tendon is sometimes useful.

Nerve-grafting offers some hope of good results, but this method is as yet in its infancy, and requires more scientific handling than it often obtains.

It is scarcely necessary to add that nutritious food must be supplied, and appropriate tonics, such as the mixed hypophosphites, must be given when required.

PARAPLEGIA AND THE MORBID CONDITIONS ASSOCIATED WITH IT

In a work chiefly devoted to the consideration of treatment and of the causal indications which guide the medical man in his choice of therapeutical measures, it is excusable to group together various morbid processes which, differing widely in their pathological origin, resemble each other in as far as they lead to a clinical picture of paraplegia. The term paraplegia denotes a condition in which partial or complete loss of power prevails in the lower part of the body, often, but not always, associated with loss of sensation, defective control over the sphincters, alteration in the reflexes and disorders of nutrition in various tissues innervated from the lower part of the spinal cord.

Inasmuch as we shall be constantly using the terms "spastic" and "flaccid" to qualify the term paraplegia, some explanation of what these words signify is imperative. A spastic paraplegia results from an incomplete lesion of the cord above the lumbo-sacral enlargement, and is characterised by the presence of increased tone or rigidity in the muscles of the lower limbs, by the preservation of their nutrition and electrical excitability, by the exaggeration of their tendon reflexes, and further, by the presence of an extensor type of plantar response. A flaccid paraplegia, on the other hand, is occasioned (1) by a complete transverse lesion of the cord above the lumbo-sacral enlargement, or (2) by the destruction of this enlargement, and is characterised by the toneless, flabby condition of the leg muscles, which show a diminished response to electrical and other stimuli, and by the loss of all forms of reflex excitability. It may be added, incidentally, that spastic paraplegia may be associated with any degree of anæsthesia and with defective control over the sphincters, and that flaccid paralysis is usually accompanied by complete anæsthesia and by complete incontinence due to toneless relaxation of the sphincters.

We shall attain our object in the easiest way by first of all giving a short account of the various diseases which cause paraplegia, together with special remedies indicated in each instance, and by discussing in the second place the treatment of those symptoms and physical conditions which are common to all forms of paraplegia, whatever their source.

Cases of *paraplegia* fall into two main groups:—1, those due to disease of the spinal cord itself and 2, those due to lesions in the spinal cord arising from compression of extrinsic origin.

1. Acute **myelitis** is a name which suggests inflammation, but which has been applied both to cases of inflammation and to cases of vascular thrombosis. The instances of true inflammation, to which the term **infective myelitis** may be given, form the minority, and are probably always due to the action of bacteria or their toxines upon the spinal cord. The infection of the cord may be primary or secondary to infective processes in other parts of the body, especially in the pelvic organs. It may occur in the course of an acute specific fever. Exposure to cold, excessive exertion or trauma may in some cases be regarded as predisposing or determining factors. The morbid change is, as has already been stated, an inflammation of the spinal tissues which may be localised in one or two segments (transverse myelitis), may be scattered in different levels (disseminated myelitis), or beginning low down may spread in an upward direction (ascending myelitis). The result of the inflammation is a temporary or permanent destruction of function in the nerve cells and nerve tracts of those regions which are affected by the disease. Clinically, these cases of infective myelitis are characterised by their acute onset, the exhibition of pyrexia and constitutional disturbances, the frequent occurrence of pain referred to the back and sometimes to other parts of the trunk and limbs, and by the development of paralysis as well as loss or impairment of sensibility in those parts of the body innervated from the spinal cord below the uppermost level of the disease. Retention or incontinence of urine and fæces, loss of sexual activity, and a tendency to the formation of bed-sores in the anæsthetic

regions form other prominent features of the symptom-complex. The paralysis is of the spastic type in those muscles which are supplied by the segments below the level of the disease, unless the latter amounts to a complete transverse lesion, when the paralysis is flaccid throughout. Local flaccid paralysis is found in those muscles which are innervated by the segments of the cord involved in the morbid process.

The special **treatment** of cases of infective myelitis in their acute stage consists of rest in bed, the administration of a diaphoretic mixture and a purge and the alleviation of pain by the exhibition of salicylate of soda, antipyrin or morphia. Placing the patient on his side or in the prone position and the application of counter-irritants or ice to the spine are advocated by some authorities, although it is doubtful whether these measures materially affect the course of the disease. The treatment of the paralysis, the sphincter troubles and bed-sores will be discussed under the general treatment of cases of paraplegia.

When an acute myelitis is not so much inflammatory as vascular in character, it is, in the very large majority of cases, due to syphilis. These cases of **syphilitic myelitis** are probably four times as common as those caused by other infective agents. It is wrong to regard them as wholly vascular, because, although thrombosis may play an important part in their morbid anatomy, gummatous infiltration of an inflammatory type is by no means uncommon, and the arteritis which leads to thrombosis is really of the same nature.

From the clinical side these cases are characterised by their sudden or rapid onset, with or without premonitory warnings in the form of paræsthesiæ, at varying intervals after the primary luetic infection. The acute stage is often free from pyrexia or constitutional disturbance, and is seldom associated with much pain. In other respects the clinical picture is much the same as that of cases of infective myelitis described above, but another distinction may be drawn between the two by examining the cerebro-spinal fluid. In the syphilitic cases a lymphocytosis, and in the infective cases a polymorphonuclear leucocytosis is generally to be found, although this rule has exceptions.

The **special treatment** of these syphilitic cases consists in administering antisyphilitic remedies with all speed. The patient should be placed at rest in bed, mercurial ointment should be rubbed daily into the skin and iodide of potassium should be given in doses rising from 10 to 30 grains three times a day. These measures are calculated to cut short the disease, and the remaining symptoms must be treated in the same way as those of other forms of paraplegia. Unfortunately, although the disease is cut short, and recurrence may be avoided by periodical resort to similar courses of treatment, the damage already done by the morbid process is often so severe that only a partial recovery of function can be expected.

Another morbid process originating within the spinal cord and capable of producing a moderate or severe degree of paraplegia is hæmorrhage into the spinal marrow, or **hæmatomyelia.** Spinal hæmorrhage is far less common than cerebral hæmorrhage, and differs from the latter also in the fact that it rarely depends upon arteriosclerosis or atheroma. Hæmatomyelia is usually secondary to trauma, whether the vertebral column itself is severely injured or not, but it has been known to occur as the result of excessive strain or exertion, and even, in some instances, to arise in a spontaneous or idiopathic manner. The chief feature from the clinical point of view is the abrupt nature of the onset of paralysis with varying degrees of pain referred to the region in which the extravasation takes place. The severity of the initial disablement is, in non-fatal cases, rapidly modified by some retrogression of paralysis and of anæsthesia. Owing to the special liability of the cervical enlargement to this form of disease, and to the incidence of the extravasation upon the central parts of the cord, spinal hæmorrhage frequently produces an atrophic paralysis of the arms, associated with spastic paraplegia and areas of diminished sensibility in which the loss to painful and thermal stimuli is much more marked than that to touch. A hæmorrhage into the lumbo-sacral enlargement is, however, by no means uncommon; in this case the lower extremities alone are affected and a flaccid or mixed flaccid and spastic form of paraplegia results. The sphincters are interfered with just as they are in cases of myelitis, and, when the lesion is a severe one, there is a marked tendency to the formation of bedsores.

In the treatment of a case of hæmatomyelia in the acute stage, the first consideration is to secure absolute rest. No unnecessary removal or handling of the patient should be allowed, and a hypodermic injection of morphia should be given for the purpose of allaying the mental distress or physical pain. Morphia is only contra-indicated if the respiratory musculature is severely paralysed, or if the cardiac action has been profoundly affected by the shock of an accident. Skilled nursing is necessary for the prevention of bed-sores, but every manipulation must be carried out with a minimum of disturbance for some weeks after the onset of symptoms. There is rarely time for the administration of drugs for the purpose of stopping the hæmorrhage, even if we were certain that this result could be obtained. Injection of ergot has been advocated, but its efficacy is at least doubtful. The recurrence of hæmorrhage may possibly be rendered less likely, and the formation of clots may be promoted, by the exhibition of calcium salts, the chloride or the lactate, in doses of 15 grains three times a day, deserving a trial. All active treatment of the paralysis should be postponed for eight or ten weeks after the acute symptoms have subsided.

A spastic paraplegia is one of the commonest symptoms of **disseminated sclerosis**, and its development may be acute, subacute or chronic in this disease. Often the paralysis is more marked in one leg than the other, at any rate in the earlier stages of the disease, when temporary improvement and even recovery is quite likely to occur. In the late stages of the same disease a flaccid paraplegia may replace the spasticity, the exaggerated tendon jerks and clonus disappearing. In the spastic cases the motor paralysis is usually much more advanced than the sensory loss; hesitating or precipitate micturition, together with constipation or lack of control over defæcation, is generally an early symptom. One or more of the other signs of the disease, such as nystagmus, ocular palsy, optic atrophy, tremors, ataxy, paresis or paræsthesiæ of the upper extremities, go to make up the clinical picture.

Unfortunately, we are not acquainted with a remedial measure which has any specific action on the course of disseminated sclerosis, and, owing to the natural remissions and exacerbations by which the disease is characterised, it is difficult to estimate the value of any particular line of **treatment.** The use of antisyphilitic remedies is hardly worthy of trial because the morbid process is rarely, if ever, dependent upon syphilis, and the administration of iodides or mercury is often productive of harm rather than good. Tonics, especially arsenic, iron and nux vomica, are useful and should always be given a trial; but the chief consideration of the physician should be to secure for the patient rest, good food and healthy outdoor life, with freedom from care and worries. The treatment of the paraplegia and sphincter troubles will be referred to later, and any associated ataxy can be subjected to a course of Fraenkel's exercises in the way which has already been indicated in discussing the management of cases of tabes dorsalis (p. 280).

There are certain forms of combined sclerosis of the antero-lateral as well as of the posterior columns of the cord in which paraplegia is a prominent symptom during the greater part of their course. The most important of these from a therapeutical standpoint is the disease known as "**subacute combined sclerosis,**" which is a progressive complaint running usually to a fatal termination in the course of one to five years, but not often exceeding two or three. Little is known of the etiology of these cases, although it is clear that they have no such constant relation to syphilis as is exhibited by cases of posterior sclerosis. The frequent association with the spinal symptoms of a severe degree of anæmia and the occurrence of paroxysmal pyrexia and alimentary disturbances, make it probable that we here have to deal with a chronic toxæmia with, perhaps, a source of infection in the gastro-intestinal tract. The clinical course of the disease may be divided into three stages: in the first, paræsthesiæ of the extremities, together with some ataxy and paresis, especially of the legs, form the principal features; in the second, a spastic paraplegia of gradually increasing severity, accompanied by progressive impairment of sensibility spreading from below upwards and by the usual sphincter troubles related to spastic conditions, renders the patient more and more disabled; in the third and final stage, which is often instituted quite suddenly, the spasticity is replaced by flaccidity, the anæsthesia becomes more profound, and the difficulty with the sphincters and with the prevention of bed-sores is markedly increased.

The special **indications for treatment** in this disease are still obscure, but the condition of the patient is often wonderfully improved by close attention to questions of food and excretion, and especially by skilful nursing under healthy conditions. If possible, the sufferer should be placed where he can have easy access to a garden, so that he may spend as much time as possible in the open air. The tendency to increasing ataxy and spasticity may be combated by regulated exercises, passive movements and massage, and the anæmia will yield to arsenic under these favourable conditions. It is our habit to give increasing doses of Fowler's solution, beginning with three minims thrice daily, and, in addition, to prescribe bone-marrow in tablets of 3 grains each. It is certainly desirable, in our ignorance of the exact cause of infection, to endeavour to purify the alimentary canal by the employment of some antiseptic, such as salol, in 10-grain doses, or benzo-naphthol, in cachets containing from 4 to 10 grains. The use of milk which has undergone lactic-acid fermentation may very well be given a trial with the same object in view.

With regard to certain other special conditions, such as **Friedreich's ataxy** and **syringomyelia**, which depend largely upon some congenital defect or anomaly, and in which paraplegia is often present, it can only be stated that we are ignorant of any method of treatment having a specific effect upon the progress of the morbid process. In cases of syringomyelia it is important that the patient should be warned against and preserved from trivial injuries, which are liable to produce results out of all proportion to the cause.

2. We have now to consider the various forms of **compression paraplegia** due to the baneful effects of pressure exerted by morbid conditions of the vertebral column or by growths arising in connection with it.

The most common instance of compression paraplegia is seen in connection with **fracture-dislocation** of the spine, a matter in which the surgeon is more generally concerned than the physician. In such cases the history of trauma and the acute onset of symptoms render the diagnosis easy, and the symptomatology need not detain us long. According to the seat of the injury, the paralysis is of the spastic or flaccid type, although in fractures of the lower cervical vertebræ it is common to find a flaccid paralysis of the arms associated with spasticity of the trunk and legs.

It is becoming more generally recognised that the successful **treatment** of these cases must often depend upon the possible benefit to be derived from exploratory operation in the early days after the accident. In view of the fact that it is almost impossible to say in any particular case whether the symptoms of paralysis are due to irremediable laceration of the cord or whether they are the result of continued pressure exerted by a portion of displaced bone, it is advisable to give the patient the benefit of the doubt and perform a laminectomy after shock has been recovered from in many cases. The subsequent treatment of the paraplegia and its associated conditions will follow the lines about to be indicated under "symptomatic treatment."

Spinal caries is another of the common causes of paraplegia, and one which affords the medical man an opportunity of displaying considerable acumen in the choice of treatment to be pursued. A knowledge of the various ways in which paraplegia arises in connection with spinal caries is necessary if the remedial measures are to be successful. It must be remembered in the first place that paraplegia may occur without bony deformity, and secondly that the paralytic symptoms are not always due to bony displacement even when the latter is present. Pressure may be exerted upon the cord (1) by the ingrowth of fungoid granulation tissue, (2) by the intrusion of an abscess into the neural canal, (3) by the displacement of bone, (4) or it may result from a combination of two or more of these factors. In addition, the paraplegia may originate from changes in the cord, produced by interference with its vascular supply or by the extension of an inflammatory process into its substance, changes to which the term "compression myelitis" has been given in spite of the fact that true compression may not always be exercised. Except in rare cases, in which a sudden luxation causes severe bruising or destruction of the cord, the onset of the paraplegia is slow, taking many days, more often weeks or months, to reach its height. It may be accompanied by pain of the spinal-root type and may succeed by a long time, or be associated with, the development of symptoms of the bony disease. As in the instances of focal lesions of the cord, the symptoms may be divided into the local effects dependent upon the disintegration of the spinal centres affected, and remote effects, usually a spastic or flaccid paraplegia, owing their origin to defective conduction of impulses through the site of the morbid process. The course of the paralysis must necessarily vary with the treatment, the nature of the pathological change underlying the spinal lesion and the severity of the damage, but the condition must always be regarded as chronic, one which is slow to develop and slow to disappear, even when the issue is favourable. Speaking generally, the more subacute cases are found in young and the more chronic in old subjects. Remissions and exacerbations of paralysis are well known to occur, and have often no obvious relation to the progress of the osseous disease.

The question of the proper **treatment** for cases of spinal caries with paraplegia is one which has provoked considerable diversity of opinion, especially in regard to the advantages and disadvantages of operative interference. It is advisable, therefore, to describe the various modes of treatment in the first place and then to discuss their indications and contra-indications.

Preparalytic prophylaxis.—The earlier the disease of the vertebræ is recognised and treated, the less likely are cord symptoms to supervene. This is an axiom of importance, but it is not equivalent to a statement that paraplegia will not develop in cases which have had the advantage of early and good treatment. As soon as caries of the spine has been diagnosed the patient should be placed on his back and kept at complete rest in that position for many months. Fresh ventilation and as much open-air life as is practicable should be ensured. Simple nourishing food, as well as cod-liver oil, should be administered and every effort made to promote the nutrition of the patient. The question of vaccine therapy may be seriously considered in addition, but it is difficult to say at the present time how far experience will prove its efficacy.

Rest and extension.—In certain cases of spinal caries in which paraplegia has supervened, especially in young children, the adoption of simple rest under the conditions just described will suffice to restore power to the paralysed limbs in a comparatively short length of time. In others recovery will ensue after many months, even when no other remedial measures are superadded. The application of extension to the vertebral column may, and often does, make all the difference in those cases in which rest alone has proved of no avail. Extension should certainly be tried in all instances of obvious and recent bony displacement. On the other hand, it is often useless and adds to the discomfort of the patient when the deformity is of long standing. It is probably more serviceable in cases of cervical than of dorsal caries and is of little value when the lumbar spine is the seat of the disease. The employment of plaster, poroplastic and leathern jackets cannot satisfactorily replace recumbency in bed, but is necessary as a supplementary measure in order to maintain immobility for a time, after recovery has taken place. In very young children the use of bandages and splints may be necessary to ensure the requisite amount of rest. Massage, passive movements and perhaps electricity may be requisitioned while the patient is in bed in order to improve and maintain the nutrition of the paralysed limbs, so long as no undue movement is imparted to the trunk.

Operative treatment.—This should be regarded as a supplementary measure, one not to be undertaken lightly and not to replace rest and open-air treatment. It may be resorted to before rest has been tried when there are indications that no relief of pressure can be procured by the latter, or it may be employed when a course of rest has failed to produce any amelioration of the paraplegia. The evacuation of any superficial abscess must be carried out at once, and a deep abscess, if within reach, should be subjected to the same treatment, particularly when it is suspected of causing compression symptoms. Laminectomy should not be postponed until secondary changes in the spinal cord render the relief of pressure ineffectual in restoring power to the paralysed parts, and, speaking generally, it should be undertaken earlier in the case of adults than in that of children. The elasticity of the tissues in the latter permits of better results from the influence of rest and extension.

In spite of the success which attends operation in some suitable cases, it must be remembered that spinal caries is not one of those conditions in regard to which it may be said that an operation can do no harm. There are instances in which surgical interference has appeared to excite the lesion into renewed activity and others in which a fatal issue from tubercular meningitis has rapidly followed.

It may justifiably be hoped that the use of skiagraphy will encourage and promote that careful selection of cases for operation which is necessary to bring this treatment into the position it deserves. Equally important is it that emphasis should be laid on the after-treatment of operation cases, so that each may enjoy for a prolonged period the rest, fresh air and good nourishment which are essential for the attainment of satisfactory results. Finally, no hesitation should be felt in advising laminectomy when the patient's life is seriously threatened by increasing respiratory embarrassment, as is not unfrequently the case in caries of the higher spinal regions.

Compression paraplegia may result from the growth of **tumours** in the neighbourhood of the spinal cord. These may originate in the vertebral column or surrounding tissues, in the extradural space, in the intradural space, or in the cord itself.

True vertebral tumours are more often malignant than benign, and more often secondary than primary. Carcinomata, which are always secondary and often follow similar growths in the breast, œsophagus or uterus, occur more commonly in women than men. Sarcomata, which may be either primary or metastatic, occur with equal frequency in the two sexes. Myelomata may also affect the spinal column, but are distinctly rare. Among the intravertebral neoplasms, sarcomata, endotheliomata, fibromata, fibro-myxomata, neuro-fibromata, gummata, tubercles and intramedullary gliomata are the most common varieties. The occasional occurrence of hydatid and other parasitic cysts must not be forgotten when the source of a compression paraplegia is being looked for.

The symptoms arising in connection with spinal tumours may be conveniently divided into (a) those which are associated with disease of the bone, (b) those indicating involvement of the spinal roots, and (c) those referable to derangement of the functions of the spinal cord.

The vertebral symptoms are most prominent in those cases in which the neoplasm originates in the spinal column, and are therefore exhibited most strikingly in instances of carcinoma or sarcoma. Pain referred to some part of the back, dull, boring or aching in character, and liable to exacerbations either spontaneously or as the result of pressure, of movement or of concussion, is usually the earliest sign of disease. The patient holds himself stiffly, and the observer detects limitation of the normal mobility of one or more parts of the spine, which may be tender on palpation. In some cases obliteration of the natural spinal curves, with shortening of the column as a whole, may attract attention; in others the formation of abnormal kyphoses is equally striking.

The spinal root symptoms comprise radiating pain referred to the distribution of the afferent root fibres, hyperæsthesia or anæsthesia in similar areas, and atrophic paralysis of the muscles supplied by the efferent fibres. Herpes zoster is sometimes associated with the other evidences of radicular involvement.

With compression of the cord itself arise those symptoms indicating interference with the conductivity of the long spinal tracts; paraplegia, at first spastic and later flaccid in type, anæsthesia in the parts supplied by the segments below the seat of the lesion, defective control over the vesical and rectal activities and a progressive tendency to the formation of bed-sores.

It would be quite out of place to discuss here the localisation of these tumours, and we must be satisfied with the very brief description of their chief symptoms. Emphasis need only be laid on the fact that a painful paraplegia which is slowly progressive is characteristic of cases of spinal tumour.

The **treatment** of these cases affords a striking example of the advance of medical science. Twenty years ago all were hopelessly incurable; to-day some are cured and others derive benefit or relief. It must be at once stated, however, that nothing can be done to stay the course of the malignant tumours of the vertebral column itself. The victims of this painful affection can only be treated with the hope of alleviating suffering, and in order to attain this end the free use of morphia is not only justifiable but clearly indicated. It may occasionally occur that an operation is necessary to clear up the diagnosis, when the disease is localised to one part of the column, and an opportunity may be offered for dividing some of the posterior spinal roots after the incurable nature of the trouble has been demonstrated. This opportunity should be seized in order that the patient may be spared as much distress as possible.

In all cases of localised *intravertebral* tumour, except when it is certain that the growth is intramedullary, an exploratory laminectomy should be performed as early as possible in the hope that the neoplasm may be found to be removable. This is an operation which can do little harm in skilled hands, and which affords the only possible source of relief or recovery. Before advising surgical interference the possibility of a gummatous growth must always be considered, and, if the question cannot be settled either from the history of the patient or from the examination of the cerebro-spinal fluid removed by lumbar puncture, a course of iodides and mercury must be tried for two or three weeks. The treatment of inoperable nonsyphilitic cases can only be palliative, attention being directed not only to the relief of pain, but to the prevention of cystitis, pyelonephritis and bed-sores.

A more rare cause of compression paraplegia, **aneurysm of the aorta** eroding the vertebral column, need only be mentioned because it is not always easy to differentiate from cases of tumour. It offers no opportunity for special methods of treatment, but it certainly contra-indicates surgical exploration.

Localised thickenings of the meninges or *meningeal cysts* can rarely be distinguished from other forms of growth until they are laid bare by the surgeon, nor do they call for any special therapeutic measures.

Chronic spinal meningitis is a rare condition, and, if it does not yield to antisyphilitic remedies, is probably unaffected by any other methods of treatment we can devise.

Symptomatic Treatment of Paraplegia

Certain symptoms are common to all forms of paraplegia whatever their origin, and their treatment is a matter of very considerable importance.

Sphincter troubles.—With regard to the bladder, we may have to deal both with retention and with incontinence of urine. To relieve the former a soft catheter, rendered thoroughly *aseptic*, must be introduced into the bladder, which should be emptied as completely as possible. There is a great tendency in these cases for the urine to become infected in the bladder, and so set up a septic pyelitis and nephritis which may prove fatal. There are several drugs which may be given by the mouth, and which, being secreted with the urine, prevent its decomposition by their antiseptic properties. One of the best of these is salol, which may be given in 10- or 15-grain doses three times a day; or boric acid in 10-grain doses; or sodium benzoate or salicylate may be employed in the same doses; urotropine, in 5- to 10-grain doses, is much used now for preventing decomposition of the urine. If these measures fail, we must wash out the bladder several times a day with a warm solution of borax—60 grains to the pint—or some other weak antiseptic solution. With slight degrees of incontinence the administration of tincture of belladonna, alone or combined with tincture of nux vomica, is often very beneficial and always deserves a trial. In more severe degrees of incontinence it is easy in the male to apply an indiarubber urinal, but in the female it is very difficult to prevent bed-soiling by urine. Large sponges (frequently wrung out, and before re-application cleansed in antiseptic fluid) or absorbent cotton, covered with oil silk, may be kept applied to the genitals, which should be frequently sponged with warm water, and the spongings followed by oiling with weak carbolic oil. As the fæces when in the rectum cannot be voluntarily retained, it is advisable to wash the rectum out with a large enema of soap and water daily, so as to avoid, as far as possible, fouling the bed by involuntary evacuations. Of course, when purgatives are being given, attention must be paid lest a fluid motion be passed in the bed; and it is for this reason that, excepting in the earliest stage, it is better to withhold active purgatives and to trust to enemata to unload the large intestine. In advanced cases, if this has been neglected, large and hard accumulations are apt to form in the rectum, which have to be mechanically removed.

The **prevention of bed-sores** is of great importance, because, when once formed, in this affection, they are healed with great difficulty, and may of themselves lead to a fatal result. If there is any fear of their development the patient should be at once placed upon a water bed and constant attention paid to smoothness of sheets and the avoidance of any creases or folds against which his skin may be rubbed. The care with regard to the urinary and alvine evacuations which we have insisted on is a great help in the same direction. The lower part of the back should be frequently washed and thoroughly dried with soft towels, and, after washing, the skin should be quickly sponged with eau-de-cologne or rectified spirit, or with rectified spirit containing about 10 grains of tannin to the ounce—this is a very excellent lotion for hardening the skin and diminishing the risk of bed-sores. Any spot which looks red and tender may be protected from pressure by a soft ring-shaped pad, or a large piece of amadou plaster may be applied, with a hole in the centre. If a sore has actually formed, it should be cleansed by washing with sublimate solution, and dressed with lead or zinc ointment or carbolised vaseline.

The treatment of **spastic paralysis** which has become more or less chronic is often very difficult. In addition to his disablement the patient may suffer severely from involuntary flexor spasms which, if they occur at night, as they frequently do, are sufficient to prevent the necessary amount of sleep. Small doses of veronal, a hypodermic injection of $\frac{1}{100}$th grain of hydrobromide of hyoscine, or 20 grains of sodium bromide by the mouth, may be found useful. The liquid extract of ergot in 20- or 30-minim doses, with or without some belladonna, may be beneficial in the same connection. With some patients light mechanical extension of the lower extremities by weights attached to the ankles will check the spasms, but in all cases the avoidance of anything which stimulates the skin is important. A cradle keeping the clothes off the lower limbs is sometimes necessary to prevent the uncontrollable reflex excitation of the spinal centres. In these chronic spastic cases every effort should be made by the patient to use his paretic limbs; he should try his utmost to force impulses, if we may use the phrase, through the blocked lines. Supplementary to these efforts on his own behalf and not replacing them, some gentle massage and electrical treatment may be applied to the legs, but it is futile to imagine that such measures can directly influence the cord lesion. If the money which is wasted on massage and electrical therapy in this country could be devoted to the promotion of research, the sum of human suffering might be much more rapidly reduced.

With regard to **flaccid paralysis** the employment of massage and electricity for muscles which respond to some form of current, and which may reasonably be expected to receive regenerated innervation from the cord in the course of time, is not only justifiable but based upon scientific principles. Unfortunately, there is no reason to believe that electricity can in itself influence the restoration of the nervous paths, and its use, therefore, when all response in the way of muscular contraction has ceased, savours of quackery rather than of medicine.

The general management of cases of chronic paraplegia when all recovery which, in view of our pathological knowledge, can be reasonably expected, has taken place, is one to tax the resources of the medical attendant to the utmost. With the well-to-do classes the patient may be advised to have resort to thermal baths, and especially to the cooler "indifferent" baths of Wildbad, Gastein, Rugetz, Schlangenbad, etc., or to the gaseous brine baths of Nauheim or Rehme, or to certain sulphur baths, such as Aix-la-Chapelle. They are usually situated in agreeable localities, where a great part of the patient's time can be passed in the open air, and the hygienic conditions present, as well as the regular systematic treatment, are no doubt as well calculated as any remedial measures can be to effect some improvement in these always protracted and often hopeless cases. Counter-irritation of the spine, in the form of the actual cautery (Paquelin's), appears to be of use occasionally, but the employment of strychnine must be avoided when spasticity is a prominent symptom.

Caisson disease is a comparatively rare condition which deserves a few words in respect to its special treatment. The typical symptoms of the disease arise after the patient emerges from the air-lock, and comprise severe pains in the limbs and trunk, paralysis of the lower extremities and of the bladder, in addition to headache, vomiting, epistaxis, hæmoptysis, etc. The most successful treatment is to replace the patient in the air-lock, to compress him slowly and then very gradually to decompress him. The other symptoms will disappear with rest, although catheterisation for the emptying of the bladder and morphia for the relief of pain and restlessness may be necessary.

PROGRESSIVE MUSCULAR ATROPHY. AMYOTROPHIC LATERAL SCLEROSIS. BULBAR PARALYSIS

These related affections, dependent on slow atrophic changes in the upper and lower motor neurones of the cerebro-spinal system, offer little scope for therapeutic consideration. Most physicians regard them as altogether incurable and irremediable. Should there be any suspicion of a syphilitic taint, mercury and potassium iodide should, of course, be administered. It is possible, as some have taught, that improvement occasionally attends the prolonged use of quinine, arsenic, iron, and strychnine. Gowers advises hypodermic injections of strychnine (gr. $\frac{1}{60}$), with morphine (gr. $\frac{1}{30}$). In those cases attended with muscular spasm (spastic paraplegia), systematic *massage* appears to have been the most useful of all therapeutic measures. Some writers advocate the persevering use of the continuous current. Some difficulty will commonly be encountered in feeding "bulbar" cases. It will be found that pulpy semi-solid food is swallowed better than liquids. Pounded fish and meat may be made up with white of egg, or clear soup, into a paste. Meat or fruit jellies can also be taken, but all *hard* substances must be avoided. If swallowing is no longer possible, food may be given by means of a soft rubber tube and funnel, the tube passing through the mouth or nose. These patients require to be watched while eating, lest food should suddenly become impacted in the glottis and cause suffocation.

ADDITIONAL FORMULÆ

For locomotor ataxy

℞ Argenti nitratis, gr. vijss.
Extracti et pulveris glycyrrhizæ, q.s.

Dissolve the nitrate of silver in a very small quantity of distilled water, and then add the other ingredients and make into fifty pills. One night and morning. (*Bamberger.*)

For locomotor ataxy

℞ Zinci phosphidi, gr. xij.
Pulveris glycyrrhizæ, gr. xx.
Syrupi et pulveris acaciæ, q.s.

Ut f. pil. centum. One to five daily. (*Vigier.*)

For the lightning pains of locomotor ataxy

℞ Sodii bromidi, ℥ij.
Extracti ergotæ fluidi, ʒjss.
Aquæ camphoræ ad ℥iv.

M. f. mist. A teaspoonful every four hours. (*Hamilton.*)

In locomotor ataxy

℞ Acidi phosphorici diluti, ʒvj.
Syrupi, ℥iij.

M. f. mist. A teaspoonful, increased to a dessertspoonful, in water thrice daily. (*Lambert.*)

Tonic in locomotor ataxy

℞ Sodii glycero-phosphatis, gr. xv.

To be taken three times a day for a long period. (*Starr.*)

For myelitis

℞ Sodii iodidi, gr. xxx.
Syrupi aurantii. ʒv.
Aquæ ad ℥vj.

M. f. mist. To be taken daily. (*Bamberger.*)

For myelitis (early stage)

℞ Ergotini, gr. xlv.
Sacchari albi, gr. lxxv.

M. et divide in pulv. xv. One three times a day. (*Benedikt.*)

For subacute cases

℞ Extracti physostigmatis, gr. lxxx.
Pulveris et extracti glycyrrhizæ, q.s.

Ut f. pil. xc. One three times a day. (*Benedikt.*)

CHAPTER III

TREATMENT OF NEURALGIAS, AND OF NEURITIS, LOCALISED AND MULTIPLE

Neuralgia—Definition.—Etiology—Symptoms—*Treatment*—Causal Indications—Baths in Gouty and Rheumatic Cases—Potassium Iodide—Mercurial Inunction in Syphilitic Cases—Cases associated with *Anæmia*—Arsenic—Iron—Strychnine—Cod-liver Oil—Chalybeate Baths and Waters—*Malarial* Cases—Quinine and Arsenic—*Neuropathic* Cases—Rest Cure—Hydrotherapy—Bromides—Valerianate of Zinc—Massage. *Pain-relieving Remedies:* Counter-irritation—Stimulating and Anodyne Embrocations—Blisters—Thermo-cautery—Electricity—Acupuncture—Aquapuncture—Local Application of Cold—Narcotic and Analgesic Drugs: Opium, Belladonna, Aconite, Veratrine, Cannabis Indica, Menthol, Chloral, Butyl-chloral, Chloroform Injections, Gelsemium, Antipyrin, Pyramidon, Phenacetin, Exalgin, Cocaine, Osmic Acid—Phosphorus, Ammonium Chloride, and other Drugs.

Special Forms of Neuralgia—*Trigeminal Neuralgia*—Iron, Quinine, etc. etc.—Surgical Measures—*Sciatica*—Opium and Sulphur—Rest Cure with Ice-bag, etc. etc.—Thermal Bath Treatment—Mechanical Treatment—*Cervico-occipital, Cervico-brachial, Intercostal, Coccygeal, Lumbar and Plantar Neuralgias.*

Neuritis—Localised and Multiple—Localised Neuritis—Causes—Symptoms—*Facial Paralysis*—Its Treatment—*Oculo-motor Paralysis*—Operation in Sciatic Neuritis—Summary of Treatment—*Multiple Neuritis*—Etiology—Usually Toxic—Alcohol the most common Cause—Symptoms—Treatment.

Additional Formulæ.

The term neuralgia should be restricted to a painful, often paroxysmal, affection of some peripheral nerve the exact pathology of which is still unknown. The pain which results from compression of a nerve by a tumour or from the involvement of a nerve in an inflammatory focus ought not to be termed neuralgia. We are not in the habit of calling the pain of pericarditis, of pleurisy, or of mammary cancer neuralgic, and it is no more reasonable to apply that name to sciatic pain when it results from a pelvic tumour or to trigeminal pain owing its origin to a growth at the base of the skull. It is the first duty of a medical man, when confronted with a localised pain, to exclude such gross causes for its production before he utters the word neuralgia, qualified or not by such adjectives as rheumatic, gouty, and the like. The fact that a nerve, which has for a long time been the seat of pain, appears on exposure to be hyperæmic or swollen or thickened, does not in itself afford a scientific explanation of the pathogenesis of the condition, and the term neuralgia may be preserved for such cases when there is no evidence, clinical or anatomical, that degenerative changes in the neural parenchyma are present. A chronic neuralgia may be associated with some general wasting and flabbiness of the muscles in the distribution of the nerve and with subjective paræsthesiæ along its course, but the affection should be diagnosed as neuritis when true muscular atrophy with electrical reaction of degeneration, anæsthesia or loss of reflexes is found in its area of supply.

On the other hand, it may be assumed that occasionally a functional disturbance of a nerve may in time develop structural alterations, and that that which began as a neuralgia may end by being a neuritis.

The etiology, like the pathology, of neuralgia is often obscure ; it is found associated with **anæmic** states, and with enfeebled and debilitated nervous systems ; it is prone to occur in the female sex especially, and in the members of neuropathic families ; it can often be traced to certain morbid states of the blood, as malarial infection, gout, rheumatism, diabetes, lead-poisoning, etc. ; exposure to cold will act as an exciting cause in predisposed persons ; arteriosclerosis and senility are also to be enumerated amongst the predisposing causes, but in very many instances all attempts to trace its causation are fruitless.

We are disposed to think that vaso-motor disturbances are frequently at the root of many cases of idiopathic neuralgia. The remarkable manner in which the pain often comes and goes, or increases and diminishes in intensity, supports this view; and it is especially amenable to remedies that exert some influence upon vaso-motor activity.

Neuralgias are sometimes referred to reflex irritation, as in the case of carious teeth exciting neuralgia of branches of the fifth nerve which are not directly connected with the offending tooth; but in this connection it is curious to note that, although children frequently suffer from toothache and often have a number of carious teeth, they rarely have neuralgia, while they are particularly prone to certain forms of *reflex* irritation.

The following are the chief characteristic **symptoms** of neuralgia. There is often complaint of some uneasy sensation or tingling in the part affected before the severe attack of pain comes on; the pain is usually confined to one or more of the ramifications of a particular nerve, and is almost always unilateral; although there may be constantly some tenderness on pressure over the affected nerve, especially at certain points (*points douloureux*), particularly where the nerve escapes from a bony canal, or perforates a fascia or approaches the surface, the *severe* attacks of pain come on in paroxysms, spread along the course of the nerve, increase in intensity until they are almost unbearable, last a variable time, with *remissions* and exacerbations, and then gradually subside. Singular trophic or vaso-motor changes are sometimes associated with the attacks. The corresponding area of skin may at first become pale and cold, and subsequently red and injected. In trigeminal neuralgia we may note increased secretion from the related mucous membranes and secreting glands. The attacks are apt to occur periodically at regular intervals, and at about the same time of day. This periodicity of attack is not limited to malarial cases. Movements of the parts affected, or mental excitement, will often induce an attack. Liability to such attacks of neuralgia may exist for many years, and sometimes continues through the whole of life.

The successful **treatment** of *all* forms of neuralgia will, in the first place, depend on a careful and painstaking investigation of the peculiar constitutional or other conditions under which the trouble has arisen, and especially as to its possible dependence on central organic lesions. The employment of mere pain-relieving remedies, while no attempt is made to fulfil causal indications, will often have the effect of doing more harm than good. It may in some cases be exceedingly difficult to trace out the true causal relations of the affection, and we may then have to rely chiefly on analgesic measures ; but this will not often be the case, and it is generally better to attack a hypothetical cause than wholly to set aside etiological considerations.

We shall, therefore, consider, in the first place, how we may best fulfil the **causal** and **general indications** in the treatment of neuralgias ; we shall, secondly, review the various measures that may be useful and necessary for the direct relief of the great symptom **pain ;** and thirdly, we shall examine the special modifications of treatment applicable to the different anatomical varieties of the disease.

1. It is hardly necessary to say that, if the disease is dependent upon pressure on the nerve in any part of its course, by outgrowths, tumours, foreign bodies, etc., surgical treatment can alone prove efficacious, except in the case of gouty, rheumatic, or syphilitic deposits or growths, when treatment appropriate to the constitutional state may cause the disappearance of the compressing agent, and so lead to the cure of the pain.

If neuralgic attacks occur in persons who are of **rheumatic** or **gouty** diathesis, treatment must be directed, not only to the relief of the morbid state of the blood, but also to the *local* changes that are apt to exist, such as deposits about the articulations or inflammation of fibrous structures—the sheaths of nerves, fasciæ, etc. Local applications, as well as general remedies, are, therefore, indicated in such cases. Counter-irritation over the seat of pain by flying blisters, or iodine paint or stimulating terebinthinate liniments, is most useful. Hot baths are also of great service; and in chronic cases hot mineral-water baths, of which the indifferent thermal baths have attained perhaps the highest reputation, such as Buxton and Bath, in England, and Ragatz, Wildbad, and Gastein, on the Continent; or the *salt* baths, such as Droitwich and Woodhall in England, Weisbaden, Ischl, and Bourbonne, abroad; in other cases, specially those caused by metallic poisons, the sulphur springs prove most useful, as Harrogate and Strathpeffer, in Britain, Aix-les-Bains, in France, Aix-la-Chapelle, in Germany. At most of these spas massage and electrical treatment are applied as potent auxiliaries.

In the rheumatic cases salicin or the salicylates should be tried in combination with alkalies; and in gouty cases, the value of lithium and potash salts, as well as colchicum (which occasionally acts with magical rapidity in purely gouty neuralgias), should not be overlooked.

We would call particular attention to the value of *potassium iodide* in the treatment of these forms of neuralgia; we consider the limitation of the use of this drug to the treatment of syphilitic neuralgias alone a great error; and when we encounter, in hospital practice, a refractory case of neuralgia, more particularly of the sciatic nerve, we invariably order full doses of potassium iodide, and frequently with most satisfactory results.

Even if there is only a remote possibility of a syphilitic origin of the neuralgia, potassium iodide, in full and increasing doses, should always be given, and mercurial oleates, or some other mercurial preparation, combined with camphor or menthol, should be rubbed in over the painful nerve.

Neuralgias dependent, as they very often are, on **anæmia**, *chlorosis*, and depressed states of general health, and defective nutrition, require vigorous tonic treatment, hygienic, dietetic, and medicinal. Free, but not fatiguing, exercise in the open air, *relaxation from work*, freedom from anxiety and mental excitement, plenty of sleep, removal, when practicable, to some sunny, yet bracing, mountain station, and a liberal diet, including a free supply of cream, butter, oil, or any agreeable form of fat, are all of remedial value. Full doses of iron are needed in many cases, and if this does not agree well, arsenic may be given instead; the sodium arsenate is, perhaps, the best preparation—$\frac{1}{16}$th of a grain, gradually increased to $\frac{1}{8}$th of a grain, may be given after meals thrice daily; or arsenic and iron may be given together, and a very effective tonic is a combination of the liquor arsenici hydrochloricus and the tinctura ferri perchloridi. In some instances, as in delicate anæmic women, who cannot digest any of the ordinary preparations of iron, resort to a chalybeate spa, such as Schwalbach, Pyrmont, or St. Moritz, is often attended by most satisfactory results; the combination, at these spas, of the warm chalybeate baths, charged with carbonic acid gas, the open-air life, the easily digested light, sparkling iron-waters, and the physical and mental rest, proves one of the most efficient modes of treatment of some forms of anæmic neuralgia.

Strychnine is a valuable addition to an iron tonic in these cases; it promotes appetite and tends to restore muscular tone. Cod-liver oil is also of great value, especially when neuralgia occurs in growing girls.

If the neuralgia can be traced to **malarial** infection, and if it is very distinctly intermittent in its attacks, it will often be found to yield to full doses of quinine or arsenic. Oppenheim advises quinine in doses of 15 to 30 grains in such cases.

The **neuropathic** or **neurotic** constitution is especially prone to suffer from neuralgic attacks, and these cases especially require treatment appropriate to the constitutional state. A "partial rest cure" is very useful in such cases. This consists essentially in giving the patient a large amount of digestible food, with more rest than is ordinarily taken, and employing massage. The judicious application of hydrotherapy in a special institution, together with electrical treatment and massage, may be arranged so as to combine this "partial rest cure" with these other nerve-calming and nerve-bracing influences. When it is not practicable to carry out the preceding modes of treatment, the bromides may be cautiously administered, but the *valerianate of zinc* will often answer better, as it does not depress the general health like the bromides. However, it must be admitted that some neurotic patients bear bromides exceedingly well, and are enabled to lead a much more active life under their influence than they otherwise would. There is certainly no reason why the sodium bromide, in 15- or 20-grain doses, should not be given at bedtime and once during the day; but it should not be given continuously, or the habit of bromide-taking may be established.

Massage may be looked upon, in many cases, rather as a *general* than a local remedy, for *general* massage improves the tone and raises the vigour of the whole body; and it has been found to act as a curative agent in many forms of neuralgia, quite independently of local treatment. It is, however, in sciatica that the value of massage, as a means of cure, has been especially established; and we shall return to its consideration when we deal with this special form of neuralgia.

2. The remedies at our disposal for the direct relief of the **pain** of neuralgia are embarrassingly numerous. Many are in the form of *external* or local applications over the affected nerve, and these we will consider first.

Counter-irritation is certainly a most valuable measure for the relief of many forms of neuralgia. This may be applied in the form of stimulating embrocations or mustard plasters, or blisters, or the actual cautery, or the electric brush.

Stimulating liniments applied with brisk friction over the surface, and mustard plasters, are particularly suitable to mild and recent attacks, but they must not be expected to yield any brilliant results in the more severe and obstinate forms. Probably the rheumatic and congestive forms, arising from chill, are the most amenable to friction with stimulating liniments; the turpentine, and the turpentine and acetic acid, liniments of the B.P. are excellent for this purpose, together with some diaphoretic medicine, such as 10 or 12 grains of Dover's powder with a few drams of liquor ammonii acetatis. In some cases a combination of stimulant and anodyne answers well; and to this end we can prescribe a mixture of equal parts of mustard liniment and opium liniment, or of compound camphor liniment and belladonna liniment.

Slight measures of this kind will often suffice to relieve mild neuralgic attacks coming on from exposure to chill.

Blisters are exceedingly useful, and their repeated application will often suffice to cure severe and protracted cases. The ordinary emplastrum cantharidis is the best agent for this purpose; and in many cases it is sufficient, and far more agreeable to the patient, to apply *small*, and what are termed *flying*, blisters—*i.e.* blisters not bigger than a shilling or a florin, moved from spot to spot, along the course of the painful nerve. Some apply them over the "painful points," others prefer to place them over the spinal origin of the nerve. In sciatica we have obtained the best results by applying the blister first over the emergence of the nerve-trunk at the sciatic notch, and then following the course of the nerve and its crural branches downwards until the pain has disappeared. When *flying* blisters are used, they should not be left on more than two or three hours over each spot, according to the sensitiveness and delicacy of the skin. In some individuals no vesication will be occasioned by these flying blisters; but if vesication occurs, much care should be taken in dressing the blisters. Nearly all the annoyance of blisters arises from careless dressing. The principle to be remembered is, that the dressing of a blister should be applied *firmly* and *immovably*. After pricking the vesicle at the most dependent part, and allowing all the fluid to run out, a piece of lint, a little bigger than the blister, should be spread with vaseline or some simple ointment, and applied over it; upon this a somewhat larger pad of cotton-wool should be placed, and the whole *firmly secured* by *broad strips of adhesive plaster*. Too frequently the dressing is secured by a handkerchief or a bandage, which loosens and rucks up, and the blistered surface becomes irritated, and does not heal quickly. If the plan we have described is adhered to, the blister will quickly heal, and may be, before long, repeated if needful.

The actual cautery, and especially the thermo-cautery of Paquelin, is a very efficacious remedy in many forms of chronic neuralgia. If the pain is very limited in area, it may be applied in *points* (*pointes de feu*); but if the pain is more diffused, what is termed "transcurrent cauterisation" acts best; for this purpose the Paquelin cautery is heated nearly to a white heat, and is then drawn swiftly and lightly along the course of the branches of the affected nerve.

Some employ a heated metal button or bulb, and apply it along the course of the nerve; this may be heated to any degree in the flame of a spirit-lamp, or it may be used in some cases simply at the temperature obtained by plunging it in boiling water. To avoid the pain of cauterisation, some first apply ether spray to the parts to be cauterised.

Electricity is one of the most efficacious of the local agents employed in the cure of obstinate chronic neuralgias. "The specific action of electricity upon neuralgias," says Jacoby,* "is generally recognised, but whether it is dependent upon the production of an altered state of excitability in the hyperæsthetic nerve or upon the direct production of anæsthesia through strong counter-irritation, cannot be stated with any degree of assurance."

The "sedative" method consists in the application of the "stabile galvanic anode. A current strength of from 2 to 8 milliampères may be used, depending upon the situation of the nerves, the duration of the affection, and the sensitiveness of the patient. The current should be allowed to pass from 5 to 10 minutes, and then gradually be diminished to zero, when the electrodes are to be removed. The *anodal electrode*, which should be small and round, and have a well-moistened sponge or cotton covering, is to be placed directly over the painful point of the nerve, while the *kathode*, a large flat sponge or cotton-covered electrode, may be placed over the related plexus or the nape of the neck. Several nerve points may thus be treated successfully at one sitting." The current must be *gradually* introduced and *gradually* diminished.

In cases in which this method fails, *counter-irritant methods* may succeed. *Jacoby* puts "*stabile franklinisation*" first of this class. "A metal ball electrode should be placed over the painful points, after which the discharging rods, which have been kept in contact until this time, should gradually be separated from each other until the pain becomes unbearable. More than one or two minutes of such treatment can rarely be borne."

The *faradic brush* offers another form of counter-irritation. The painful points are treated "with a strong secondary current for from one-half minute to one minute." Jacoby considers this method too painful and does not recommend it. He considers that "in the very early stages of *acute neuralgia*" no form of electricity should be applied, but when the pain "has a tendency to persist, becoming *subacute* or *chronic*, electrical treatment should be resorted to. . . *Old chronic neuralgias* are best influenced by *labile galvanic* applications or by *counter-irritant* methods." At first, application should be made daily or twice a day, and later on every second day. He considers that the "so-called *rheumatic neuralgias* and the *traumatic* neuralgias are the most favourable cases for successful treatment by electricity."

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* Cohen's "System of Physiologic Therapeutics," vol. ii., Electrotherapy, p. 170. Rebman, 1901.

Other local measures, such as **acupuncture,** have been employed, not with the idea of producing any revulsive effect, but with the possibility of relieving some tension of the nerve-sheath, or otherwise influencing locally the morbid state of the nerve. This is a method occasionally employed by surgeons, especially for the relief of sciatica. Long, stout needles are pushed deeply down to the situation of the affected nerve, the sheath of which, it is hoped, may be pierced. Several needles are thus introduced along the course of the nerve, and, after a few minutes, withdrawn.

Aquapuncture, or the deep injection of a small quantity of water into the nerve or its vicinity, has been said to be sometimes followed by relief.

The local application of **cold,** either by means of ice-bags or evaporating agents, often acts as a useful palliative in certain cases, although it can rarely be relied upon as curative. Ether spray, a jet of compressed carbonic acid or of methyl chloride can be used to produce intense cold, but it is best to stop short of freezing. The application for three or four seconds of a jet of *methyl chloride* has been advocated by Débove and Bardet for the relief of sciatica; but it is a severe measure, and should be reserved for very refractory cases.

Many remedies directed to the relief of the *pain* of neuralgia are applied both internally and externally, and these two modes of application it will be convenient to consider together. We shall, therefore, now pass on to the examination of the many anodyne, narcotic, and "analgesic" drugs employed in the *treatment* of this disease.

Opium and its derivative **morphine** are almost indispensable in the treatment of severe neuralgias. To relieve the excruciating, distracting pain without delay is, in some instances, a pressing necessity; and for this purpose no drug is so reliable as morphine given hypodermically, yet none of the many remedies used in the treatment of neuralgia needs more care and caution in its application.

It has been stated, and with perfect truth, that most of the cases of morphine-craving have originated in the use of that drug for the relief of neuralgia. There is also another danger which not unfrequently attends the hypodermic use of morphine, and that is serious depression of the cardiac action in persons who have weak and flabby hearts. To avoid these risks it is most important, in the first place, not to have recourse to morphine injections except in cases of very severe pain, which have resisted other remedies; or to give it, once only, for the immediate relief of the pain and until other remedies can be made to act. Another caution to be observed is to use the smallest dose possible; try $\frac{1}{8}$th or $\frac{1}{6}$th of a grain at first, and if that succeeds do not increase it. Give even a smaller dose than this if there is any weakness of the cardiac muscle (in chronic valvular disease, especially aortic disease, in small doses, morphine often steadies the cardiac action), and combine, in this and in most other cases, a small dose of sulphate of atropine with the morphine. It is best to use the hypodermic tabloids now so generally prepared, and to dissolve them in distilled water or water that has been boiled, and to see that the syringe employed is quite aseptic. Tabloids of the following strength can be obtained: Morphine $\frac{1}{12}$ grain, and atropine $\frac{1}{250}$ grain; morphine $\frac{1}{8}$ grain, and atropine $\frac{1}{200}$ grain; morphine $\frac{1}{6}$ grain, and atropine $\frac{1}{150}$. These are the most convenient strengths, as two can be used if larger doses are needed. It does not matter, as a rule, where the injection is made. In some cases, however, injection over the seat of pain seems to be the more efficacious. The pain once relieved, in some cases it does not return; and we should be particularly careful not to allow any urging on the part of the patient to induce us to inject morphine as a precautionary measure. In some cases it has been found necessary, in order to satisfy the patient, to make an injection of *distilled water* only, and frequently it has been found to answer well.

Local frictions with opium liniment, combined with moist heat, will relieve some of the slighter and more diffused neuralgic pains.

We have already referred to the use of *atropine* combined with morphine; it undoubtedly increases the efficiency of the latter. *Belladonna* has also been used internally for the relief of neuralgia. Formulæ for its administration will be found at the end of the chapter: the liniment is a useful external application for the milder forms, and may be applied mixed with an equal part of chloroform liniment.

Aconite and *aconitine* are also anti-neuralgic remedies, which are used both internally and externally. They are of chief value in trigeminal neuralgias. Duquesnil's crystalline aconitine in doses of $\frac{1}{250}$ to $\frac{1}{100}$ grain may be given until it causes slight tingling or numbness of the face and lips. The ointment of aconitine or the aconite liniment may also be rubbed in along the course of the painful nerve.

Veratrine in solution in oleic acid (2 per cent.) rubbed in along the painful nerve will often allay the pain, at any rate for a time.

Cannabis indica is an old and favourite remedy with many for facial neuralgia.

Menthol has been given *internally* in neuralgia, but of its usefulness thus administered we have no experience. Applied externally, however, it is of great service in allaying mild forms of neuralgic pain.

A liniment composed of menthol 8 parts, chloroform 4 parts, and olive oil 10 parts, is a useful mode of applying it, or an ethereal solution (1 in 10) may be painted on with a brush.

Chloral is of little use internally for the relief of neuralgia; it may, however, be usefully given to assist in procuring sleep, combined with an equal quantity of bromide of sodium, in certain obstinate cases, but it has little influence over the *pain*. The liquid formed by rubbing together equal parts of chloral and camphor we have, however, found of great service when applied externally in cases of symptomatic neuralgia, and perhaps a better mixture for the purpose is made by rubbing together 3 parts each of chloral and camphor with 1 part of menthol.

Croton-chloral or *butyl-chloral hydrate* is one of the most reliable remedies in the treatment of facial neuralgia. We were among the first to call attention to the value of this drug in these cases. It may be given in 3-grain doses made into pills with glycerine of tragacanth, or, preferably, in solution, 2 to 5 grains dissolved in a little glycerine (20 minims) and orange-flower water (1 ounce). This dose may be given every hour for four doses; if by that time it has had no effect it may be set aside as unsuitable for the case in hand.

We have already alluded incidentally to the use of *chloroform* externally for the relief of neuralgic pain; but it is rarely used alone for this purpose, being usually advantageously combined with other narcotics. It is to its use in the form of *hypodermic injections* that we now wish to refer. It has given excellent results in the hands of Bartholow, Besnier, Dujardin-Beaumetz, and others. Five to 10 minims or more may be injected *deeply* over the painful points; for this purpose a long stout needle should be used, and thrust down perpendicularly as far as it will go; it is therefore in sciatica that this method is chiefly applicable.

Gelsemium, the yellow jasmine imported from

Virginia, and its alkaloid *gelsemine*, have been largely used in the treatment of dental and facial neuralgia. Dr. Wharton Sinkler and other American writers regard it as a remedy of "distinct potency" in those forms dependent on dental caries. They, however, admit the variability in activity of its preparations, and counsel small doses, gradually increased, in order to avoid its toxic effects. "It is well to keep the patient under the influence of the drug for some days—just on the verge of the extreme dose, so that a slight dizziness or dimness of vision is felt for a time after taking a dose of the remedy."* We consider half a grain of the extract or 5 minims of the tincture safe and suitable doses to begin with, and such small doses may be given every six hours, or more frequently, until some remedial effect is produced. When we have satisfied ourselves as to the strength of the preparation used, and the susceptibility of the patient, larger doses may be given. We have ourselves obtained the best results from a combination of butyl-chloral and tincture of gelsemium, 3 to 5 grains of the former and 5 to 10 minims of the latter, given in a little glycerine and aromatic water.

We must next consider the use of the so-called **antithermic analgesic** drugs, so largely used of late years in the treatment of neuralgia. The chief of these are *antipyrin*, *pyramidon*, *phenacetin*, and *exalgin*.

The pain-relieving properties of **antipyrin** (phenazonum) have been utilised, with some effect, in the treatment of neuralgia, especially in trigeminal neuralgia. A dose of 15 grains may be given at the onset of the paroxysm, and the effect maintained by 5-grain doses every two or three hours, if necessary. As a rule, if no effect is made on the pain after the first thirty grains, it will be of little use continuing to give it. It may be given in the tabloid form or in cachets, but when it is desirable to get a rapid effect it is best given in solution. A mixture may be made containing 60 grains of antipyrin dissolved in 1½ ounces of peppermint water, to which 30 minims of spirits of chloroform should be added; 3 teaspoonfuls will contain the full dose of 15 grains, and a teaspoonful the subsequent smaller dose of 5 grains. It has been used hypodermically, 10 grains dissolved in 20 minims of water, in obstinate forms of sciatica; it should be injected deeply, and then the addition of $\frac{1}{10}$th of a grain of cocaine to each injection is calculated to render it painless.

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 589.

Pyramidon, a derivative of antipyrin, has been recently introduced as a remedy for neuralgia, and Oppenheim* states that he has "several times seen good results from this drug in severe chronic cases," in doses of 3 to 10 grains.

Phenacetin is a safe analgesic, and may be given in 3- to 5-grain doses every hour, until relief is obtained; if, however, after three or four doses, no effect is produced, it will be useless to continue it.

Exalgin is a valuable addition to our anti-neuralgic remedies. It is soluble in weak alcoholic solutions and less so in water, and a convenient method of giving it is to dissolve 24 grains in 2 drams of rectified spirit, and to add this to 3 ounces of a mixture of some aromatic water and syrup. One or two teaspoonfuls may be given every hour for six doses. Larger doses than this may be needed in some cases, but the effects of the larger doses should be carefully watched, as toxic symptoms have been produced by too large ones. It may be given also in 1- or 2-grain pills made up with gum and sugar, or it can be had in chocolate tabloids.

Cocaine, in strong solution, has been injected along the course of the painful nerve with success in doses of ¼ grain to 1 grain; but some consider it an *unsafe* remedy.

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* "Diseases of the Nervous System" (Mayer's translation), p. 350.

The injection of solutions of *osmic acid* (1·5 per cent.) into the affected nerves, or their branches, has been strongly commended by Bennett* and others. A small incision is made over the affected nerve, which is then hooked up and fixed. The needle of the hypodermic syringe is passed along the substance of the nerve as far as it will go. The total amount of the injection (5 to 10 minims) should be introduced at two or three separate injections, so that the nerve may be, as much as possible, soaked in the solution; while the escape of fluid from the wound is prevented by holding a pledget of sterilised wool firmly round the needle where it enters the incision. The solution blackens the soft tissues. Bennett thinks this a most successful method of treatment.

There are still other drugs to be considered which possess a certain reputation in the treatment of neuralgia, though their mode of action is not known. *Phosphorus* is the chief of these. The French method of giving it dissolved in oil in capsules, each capsule containing 1 milligramme ($\frac{1}{65}$ grain), is a convenient and pleasant form for its administration; from 3 to 10 capsules are given daily. It has proved serviceable in some cases following brain exhaustion and overwork, and Gowers relates a case of trigeminal neuralgia of thirteen months' duration that was cured after three months' treatment with phosphorus; but many physicians look upon the protracted administration of this drug with some alarm, on account of the degenerative changes it is apt to induce. Phosphide of zinc may be used instead of phosphorus, and can be conveniently prescribed in pills containing $\frac{1}{12}$ to $\frac{1}{4}$ grain. The *valerianate of zinc* has been found useful in the same type of case as phosphorus, and we have ourselves found the pill now commonly made of 1 grain of valerianate of zinc and $\frac{1}{60}$ grain of phosphorus of much value in the treatment of hypochondriacal cases with slight neuralgic pains.

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* *Lancet*, Nov. 4th, 1899.

Ammonium chloride is another drug that has been much lauded for its so-called specific effect in curing certain forms of neuralgia. It is given in solution in doses of 20 or 30 grains every four hours. It may be tried when other remedies fail, for it is difficult to say in what cases it may or may not succeed.

Neuralgia of the fifth nerve, or *trigeminal* neuralgia, is perhaps the most frequent form of neuralgia which is encountered in Great Britain. This is readily understood when we consider the number of branches of this nerve, the importance of its functions and relations, and its exposed situation. One or all of its branches may be affected.

The *supra-orbital* branch seems to be affected most frequently. The pain, which is most severe at the supra-orbital notch, spreads upwards and backwards as far as the parietal bone. Painful points have been found just above the notch, at one part of the upper lid, at the emergence of the nasal branch, at a spot over the parietal bone about 3 inches above the ear, and sometimes apparently one in the eyeball.

The *infra-orbital* branch is not often affected alone, but pain in it generally accompanies pain in the other branches. Pain in the *third division*, in the inferior dental branches, is often associated with dental caries. In all these forms exposure to cold or damp may be the exciting cause.

The more severe and intractable forms of *trigeminal* neuralgia usually come on after middle age. The pain is often agonising, and in not a few instances has driven the sufferer to commit suicide. In the form termed *tic-douloureux*, convulsive twitchings of the facial muscles accompany the attacks of pain. Sometimes the pain comes on quite suddenly with great violence, and lasts only a minute or two. This form was termed by Trousseau "epileptiform." The attacks are apt to recur at very short intervals. The affection of the infra-orbital branch is often associated with migraine. It has been suggested by Dana that this disease depends on an obliterative arteritis of the nutritive vessels of the nerve, since it is apt to occur at the age when such changes begin.

A less intense and more common form in young people is doubtless frequently dependent on dental affections, and is only amenable to the dentist's intervention.

In the **treatment** of this most painful disease the principles and observations already laid down must be borne in mind.

In ocular cases errors of refraction must be looked to, and cases associated with exhausted and anæmic states will require careful attention to the nutrition of the patient, iron and arsenic in the intervals between the attacks, and, when practicable, change to a bright, sunny, and bracing climate, which has often succeeded when other means have failed. Large doses of the precipitated subcarbonate of iron have long enjoyed a special reputation for the cure of this disease. Quinine, in full doses, will frequently relieve the periodic forms. The following drugs, to which we have already fully referred, all find their applications in different cases—some patients being susceptible to the action of one, and some to the action of another of them. Butyl-chloral, gelsemium (or these two combined), aconitine, antipyrin, sodium salicylate in rheumatic cases, cannabis indica (pushed up to the point of tolerance), a combination of cannabis indica, arsenic, and quinine, phosphorus, potassium iodide (especially useful if there is any periosteal thickening in inferior dental neuralgia). Cocaine has been instilled into the conjunctival sac, or the nasal mucous membrane has been painted with a 5 to 10 per cent. solution. The inhalation of 3 or 4 drops of amyl nitrite has cut short some attacks. Dana and Sinkler* speak highly of massive doses of strychnine given hypodermically; beginning with $\frac{1}{30}$ grain daily, it is very slowly increased up to $\frac{1}{6}$ or

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 590.

$\frac{1}{4}$ grain. Sinkler says "it often quiets the patient for hours, like a dose of morphine."

Oppenheim calls attention to the fact that purgatives and cold water enemata have occasionally proved curative.*

For *local* application, menthol, plasters or ointments containing methyl salicylate, camphor-chloral, veratrine, flying blisters over the points of emergence of the nerves, the actual cautery (which has been found curative applied to the painful point on the side of the tongue in neuralgia of the lingual branch), cocaine injected hypodermically, the methyl chloride spray, and electricity (*static* electricity has proved effectual after galvanism has failed; sparks are drawn from the painful region with the negative pole).

What is known as the *cataphoretic* method has, according to Oppenheim, succeeded in some particularly stubborn cases. *Cataphoresis* is a modification of the ordinary process of osmosis by means of the constant electric current. It has been used with cocaine and with chloroform. The electrode is fitted with a space to contain the drug and attached to the positive pole. It is placed firmly upon the nerve, and a weak current of from $\frac{1}{2}$ to 2 milliampères is used. Oppenheim claims to have obtained "temporary good results" by "energetic irritation of the soles of the feet with the faradic brush." He has not seen much benefit from *nerve-vibration* or from massage of the cervical sympathetic.

The frequent failure of all these remedies to relieve the terrible sufferings of the subjects of persistent trigeminal neuralgia has led to the employment of many surgical expedients to this end. *Excision* of the nerve is generally attended with relief for a variable time, but the neuralgia usually returns. Nerve-stretching and simple division have also been attended with relief of pain for some months. An operation for the removal of the Gasserian ganglion in long-standing and intractable cases of neuralgia of the fifth nerve has been successfully carried out by W. Rose, Keen, Horsley, Krause, and others. Statistics of this operation collected by Krause show that out of 51 patients operated upon 5 died, while the others not only survived the operation but were cured.* With increased experience, the mortality of this operation has diminished, and it affords the only trustworthy measure of relief in the really severe cases.

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* "Diseases of the Nervous System" (Mayer's translation), p. 356.

Sciatica.—Perhaps the next most common and most obstinate form of neuralgia we have to treat is that affecting the sciatic nerve. This may be dependent on gout or rheumatism, but it is, no doubt, occasionally an idiopathic neuralgia. It may, in some rare instances, be caused by the pressure of a gravid uterus, or a loaded bowel, on some part of the course of the nerve, and in obscure cases such possible modes of causation should be inquired into; for if, as some have maintained, the pressure of a loaded sigmoid flexure of the colon can cause left-sided sciatica, regular free evacuation of the bowels would be the first measure needed to bring relief. In many instances it undoubtedly arises from exposure to wet and cold, as lying when heated on damp grass, sitting on a cold stone, etc. Simple muscular over-exertion has been said to produce it.

There is usually more or less pain along the whole course of the nerve, but the most painful points are usually at the notch where it emerges and in the middle of the thigh. Numbness and tingling, and areas of paræsthesia on the back of the thigh and calf, sometimes occur; and in protracted cases the muscles of the affected limb become flabby and wasted.

Occasionally the painful attack comes on suddenly and acutely, but far more commonly the onset is gradual, and the pain is of a wearing, gnawing character.

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* Oppenheim's "Diseases of the Nervous System" (Mayer's translation), p. 351.

The **treatment** of sciatica must be determined by the acuteness or chronicity of the affection.

Acute attacks, of a possibly rheumatic origin, may yield to warm baths, or mustard plasters, and full doses of sodium salicylate; or, if of a gouty nature, to colchicum, with alkaline and saline aperients. A full dose of Dover's powder (12 or 15 grains), in a diaphoretic draught at night, is a very useful remedy in the acute rheumatic forms. Free action of the bowels should always be ensured. In chronic cases, when first seen, we should always try the effect, for a few days, of full doses of potassium iodide; this remedy, even in nonsyphilitic cases, will often be found to give complete relief in forty-eight hours. If it fails to have any remedial effects after three or four days, it may be set aside as unsuitable.

Rest in bed is the greatest auxiliary to all our other treatments. We have already pointed out how valuable counter-irritation is in these cases. Dry cups over the course of the nerve are also useful. Hypodermic injections, in the manner already described, of morphine and atropine (when the pain is intense), of cocaine ($\frac{1}{8}$th or $\frac{1}{4}$ of a grain), of antipyrin, of simple water, and of the other agents previously referred to, may all, in turns, be tried in obstinate cases. Hypodermic injections of *osmic acid* have been employed in many obstinate cases, with success. Fifteen minims of a 1 per cent. solution are mixed with enough distilled water to fill a large hypodermic syringe, and this is injected deeply into the nerve in six to twelve places between the ilium and the heel, introducing 1 to 2 minims at each insertion. It is obvious that this combines the treatment by acupuncture with that by osmic acid.

We have already referred to the use of the thermo-cautery and to electricity. Oppenheim* considers the cautery the "best remedy in old and severe cases." Massage, together with galvanism and prolonged and systematic movements of the leg, by which the nerve may be stretched without operation, has also been found of the greatest use in very chronic cases. It may be needful to continue this treatment for many months to ensure a cure.

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* "Diseases of the Nervous System" (Mayer's translation), p. 318.

The external application of *sulphur*, recently so strongly recommended by some American writers, is the revival of an old remedy. The whole leg is enveloped in powdered sulphur, which is kept in contact with the skin during the night by a flannel bandage. One or two such applications have been reported as curing severe sciaticas.

The use of *methylene blue* in the treatment of sciatica has been well spoken of by Klemperer and others. He gave it in doses of about 7 grains in *capsules*—3 to 6 daily. In these large doses it is apt to cause gastric and bladder irritation, which detracts much from its analgesic properties. It would be better to begin with smaller doses, 1 to 3 grains, and gradually increase the dose if the drug is well borne. Some pains should be taken to ensure the *purity* of the drug, as the use of impure specimens is apt to be followed by toxic symptoms. The drug first causes numbness, and this passes gradually into analgesia. Its action is temporary, so that the continuance of the remedy is needful. The patient should be warned that it imparts a blue colour to the urine.

Treatment of sciatica by *absolute rest* in bed has been warmly advocated by Weir-Mitchell. The patient is not allowed to get out of bed for any purpose whatever. He is fitted with a long splint, padded and fixed by bandages, stretching from the axilla to the heel. It is made with a joint at the knee, so that the leg may be slightly flexed, and the angle is changed at each renewal of the dressings. After a few days, passive movements, to avoid stiffness, are made at the daily change of splint. The ankle is supported with a small pillow or pad, in order that the weight of the leg shall not fall on the heel. In chronic cases dry cold is also applied by means of Chapman's ice-bags along the course of the nerve, kept on day and night for many days. If, after two or three weeks of this treatment, a cure is not effected, Paquelin's cautery is applied along the course of the nerve, and, after the healing of the blisters, gentle massage is used. "The massage should be applied with great care, lightly rubbing the surface and stroking the limb in a downward direction."

Many chronic forms of sciatica, especially when of gouty and rheumatic origin, obtain benefit from treatment at **thermal spas** at home or abroad. In all of these, nowadays, some kind of *massage* forms an indispensable part of the treatment. Bath, Buxton, Droitwich, Harrogate, are especially frequented in England; and Aix-les-Bains, Teplitz, Gastein, Baden-Baden, Ragatz, Wildbad, Wiesbaden, on the Continent. Mud baths, such as can be obtained at Matlock Bath, and hot sand baths have been found useful, and especially the Scotch douche.

Massage is of great service in the treatment of chronic forms of sciatica, and especially in rheumatic and gouty forms. It should be gentle at first, weak strokings and kneadings, for we must be careful that the irritated nerve is not further irritated by too vigorous massage. It is useful also in old cases in promoting the nutrition of the wasted muscles. In the chronic and intractable forms the application of the method recommended and practised by Dr. Schreiber at Aussee, of long continuance of passive movements, then active movements and finally massage, has been attended by some excellent results.

We must next refer briefly to the treatment of certain other forms of neuralgia. *Cervico-occipital* neuralgia affecting the posterior branches of the upper cervical nerves and the branches of the great occipital (there is usually a *painful point* midway between the first cervical vertebra and the mastoid process) is best treated by the application of dry heat or Paquelin's cautery; internally antipyrin or phenacetin will usually relieve the suffering, and in periodic cases quinine or arsenic should be given.

Cervico-brachial neuralgia involves the sensory nerves of the brachial plexus. The pain is referred chiefly to the shoulder and along the course of the ulnar nerve. Painful points are likely to be found where the circumflex nerve pierces the deltoid and over the ulnar nerve at the elbow. It is sometimes associated with rheumatism of the shoulder-joint. Sponging or affusion with hot salt and water twice daily, enveloping in cotton-wool, and keeping the arm absolutely at rest will prove curative. When more chronic, massage and hot douches are most serviceable. Galvanism, the faradic brush, or static electricity may prove advantageous in obstinate cases. In distinctly rheumatic forms sodium salicylate or salicin should be employed; or potassium iodide and colchicum will often be found more efficacious in gouty constitutions. When the general health is at fault, quinine, iron, and cod-liver oil may be needed. Treatment at a thermal spa frequently proves rapidly beneficial in this form.

Intercostal neuralgia is of rather frequent occurrence, especially in anæmic and hysterical women. *Herpes zoster* or *shingles* often accompanies or precedes intercostal neuralgia. This form owes its origin to an affection of the dorsal spinal ganglia The pain attending the herpetic eruption may be allayed by painting it over with a solution of cocaine or applying a cocaine or morphine ointment, or sometimes a lead lotion best allays the cutaneous irritation. Antipyrin or phenacetin may be given internally. Sinkler says: "The application of a 1 per cent. solution of cocaine in unguentum petrolatum is said to be an infallible and rapid cure of zoster."* If the affection becomes chronic, counter-irritation over the points of exit of the corresponding spinal nerves (either a blister or iodine paint) should be applied. Hydrotherapy, and especially the use of alternate hot and cold jets (the Scotch douche), may be tried, and often with advantage. In anæmic cases, the warm chalybeate baths and the internal use of the iron waters of Schwalbach, Spa, or some similar spring are indicated. In rheumatic cases salicin and the salicylates, or potassium iodide, may advantageously be given.

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 601.

Coccygodynia often proves a very intractable form of neuralgia, and removal of the coccyx has occasionally been resorted to, but generally without relief. Electrical treatment has, however, been said to cure many cases. Sinkler mentions a severe case which was cured by sitting on a chair which had a large hole in the seat.

Lumbar, or *lumbo-abdominal*, neuralgia differs from lumbago in radiating in various directions and not causing so much pain on movement. Frictions with stimulating and sedative liniments, such as the aconite and chloroform liniments mixed, belladonna liniment (or hypodermic injection of atropine), sodium salicylate in full doses or actæa in rheumatic forms, and antipyrin have all been used with advantage.

Plantar neuralgias, painful affections of the sole of the foot, are usually most intractable and difficult to treat. Sometimes the avoidance of any pressure on the foot and going barefooted will give relief; on the other hand, we have seen instances in which firmly bandaging the instep and front of the foot was of immediate benefit. Oleate of morphine and atropine have been applied to relieve the cutaneous sensitiveness. Dujardin-Beaumetz found sulphur foot-baths and the application of a strong tincture of iodine useful. We have injected full doses of atropine into the dorsum of the foot with advantage.

To discuss all the remedies that have been advocated for the treatment of all the various forms of neuralgia would be an endless task; we have endeavoured in the general remarks at the beginning of this chapter, and in the special references at the end, to give as full an account as practicable of the most useful measures to employ, and in the additional formulæ will be found some other valuable details for reference.

NEURITIS, LOCALISED AND MULTIPLE

We must consider the subject of **neuritis** as a disease appearing in a variety of forms, and giving rise to a series of important symptoms, the nature and origin of which it is important to recognise, in order that we may be enabled to administer effectually to their relief.

For our present purpose it will be sufficient to consider this subject under *two* divisions—(1) *localised neuritis*, or neuritis affecting any nerve, or part of a nerve, or group of nerves; and (2) *multiple neuritis*, in which affection many or nearly all the nerves in the body may be at the same time implicated. Either form may be acute, subacute, or chronic, and the symptomatic phenomena, and doubtless also the underlying physical changes, may assume very various degrees of intensity.

First with regard to **localised neuritis.** The most frequent causes of this affection are—(*a*) exposure to cold; (*b*) local injury from wounds, pressure, etc.; (*c*) the extension of inflammation from adjacent parts. Rheumatism, gout, diabetes, syphilis and other toxic agents may be also mentioned as causes.

The characteristic *symptoms* of the acute or subacute forms are—pain of an aching, burning, or boring nature along the course of the nerve affected and its branches; great sensitiveness and tenderness on pressure over the nerve trunk and its terminations; perverted sensation in the area of its distribution, such as burning, pricking, tingling, numbness, going on to definite anaesthesia and analgesia. Sometimes a more diffused sensitiveness and exquisite tenderness may be observed over a wide area of the cutaneous surface. Increased perspiration, effusion into joints, physical changes in the skin and subcutaneous tissues (redness, swelling, œdema, "glossy skin," herpes, and other eruptions), and occasionally local spasmodic phenomena may occur. In some acute cases the trunk of the nerve affected can be felt to be swollen. In chronic cases, when more or less degeneration of the nerves affected has taken place, we may encounter, as well as diminution or loss of sensation, a loss of motor power, in proportion to the extent of involvement of motor fibres. Atrophy and alteration in the electrical and reflex excitability of the muscles are generally found.

The clinical features of each case will necessarily depend on the localisation and intensity of the neuritis. If limited to the peripheral terminations of a nerve the symptoms may be mild; but if the affection diffuses itself through a whole limb or limbs, or extends to nerves, like the vagus, of vital importance, the case may assume the most grave and serious aspect. Any nerve in the body may be affected by neuritis, but we may here refer to two or three special forms on account of their frequency and importance.

Facial or Bell's *paralysis* is usually a rheumatic neuritis from exposure to chill, or it may be due to local injury, or to syphilis, or it may be dependent on otitis. If of rheumatic origin, and the case is seen, as it usually is, in the *acute* stage, a leech or two should be applied over the seat of emergence of the nerve; or a blister is preferred by some; and salicin or sodium salicylate or potassium bicarbonate should be given internally. A dose or two of calomel may also be given at first, followed by a saline aperient. The continuous local application of moist or dry heat is of service, together with rest and confinement to a warm apartment. As soon as the acute symptoms have subsided, small or moderate doses of potassium iodide are appropriate. The facial muscles should now be treated with faradism and massage. If they do not respond to the interrupted current, galvanism should be used in its place. In severe cases this treatment will need to be persevered with for many weeks or months. If there is reason to believe the affection to depend on syphilis (in that case the auditory nerve is likely to be also involved), large doses of potassium iodide and free mercurial inunction, or hypodermic injections of corrosive sublimate, should be employed.

Oculo-motor (third nerve) paralysis is usually due to syphilitic meningitis, especially when it is total. If only the external branches are involved, there is more chance of its being a true neuritis. The preceding general therapeutic directions apply to this and to other forms of localised peripheral paralysis.

Brachial neuritis of a very severe form, arising in connection with diabetes, has been found to yield to large doses of sodium salicylate, the hypodermic injection of morphine and atropine twice daily, and complete rest.*

Gowers considers that mercury exerts a distinctly curative influence over neuritis, and recommends a grain of blue pill twice a day in these cases.

In neuritis of the sciatic nerve we must emphasise the value of rest, of the local application of cold, and of anodyne remedies during the acute stage, and of potassium iodide, massage, and electricity in the chronic stage. In the latter stage Deaver and Mills have called attention to the value of **operation.** "By opening the sheath and breaking up any adhesions that may be present" the nerve is given a better chance of repair; "or, when degenerated, by disturbing the molecular condition of the nerve and stimulating it to take on regenerative action; or, again, in those cases of chronic inflammation of a nerve in which physiological movements never allow it to be sufficiently long at rest to accomplish a cure, by removing a section of the inflamed nerve and thus getting rid of the constant irritation,"* a cure may be effected.

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* Professor C. K. Mills: Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 741.

We may thus summarise the general **treatment** appropriate to these cases, according to the stage of the disease, noting at the same time that the treatment suitable to the acute and subacute stages might prove injurious in the chronic stage, and *vice versâ*:—In the *acute* stage, complete rest, with leeches, cupping, mercurials, salicylates; in the *subacute* stage, rest, gentle massage, sodium salicylate, phenacetin, quinine; in the *chronic* stage, electricity, strong galvanic or faradic currents, massage, Swedish movements, suitable gymnastics, mineral baths.

Secondly, as to **multiple neuritis.** This is a form of neuritis which is usually excited by toxic or infective agents. It is said that cold or over-exertion may in some instances act as determining factors. The abuse of *alcohol* is one of the most common causes, and the alcoholic form is the one we shall most frequently encounter clinically. Of the many other poisons that may cause multiple neuritis the following may be enumerated:—Lead, arsenic, mercury, sulphonal, ergot, carbonic oxide; the toxic substances that accumulate in the tissues in jaundice, uræmia, rheumatism, gout, diabetes; and the infections of diphtheria, measles, scarlet fever, variola, typhoid, influenza, tuberculosis, syphilis, and other infective maladies. Much excitement was caused in this country a few years ago by the widespread outbreak of arsenical neuritis from the consumption of contaminated beer in certain districts.† It has been pointed out that this disease is especially prone to occur when a person already under the influence of one toxic agent is attacked by another, as alcohol plus arsenic, or lead plus alcohol, or alcohol plus influenza, and so on.

The **symptoms** of multiple neuritis are numerous and complex, comprising phenomena of motor, sensory, reflex, vaso-motor and trophic origin. In most cases all these nervous functions are affected to a greater or less extent, but there are many instances in which one is much more profoundly disturbed than are the others. Thus, it has been sought to divide cases of neuritis into motor, sensory, and vaso-motor classes, without, however, attaining any very useful object. A tendency to use the term neuritis to explain many painful affections of the extremities without adequate knowledge of their pathology is unfortunately very prevalent, and does not lead to fresh light being thrown upon their origin. The characteristic features of multiple peripheral neuritis are (1) preliminary sensory phenomena in the form of tingling, numbness, pains, etc., in the feet and hands, (2) acute or subacute onset of loss of power in the peripheral parts of the upper and lower extremities, the extensors of the wrists and dorsiflexors of the ankles being generally more affected than the other muscles of the limbs, and the diaphragm often failing before the other trunk muscles, (3) impairment of cutaneous sensibility in the glove and stocking areas, (4) tenderness of nerves and muscles on deep pressure, (5) rapid atrophy in the paretic muscles with loss of tendon reflexes and alteration in electrical excitability, (6) vaso-motor and trophic changes in the skin, nails, and other tissues, chiefly of the hands and feet. There may be some constitutional disturbance, pyrexia, anorexia, etc., or the whole course of the disease may be afebrile. A rapid fatal termination is rare, but is always to be feared when the diaphragm is paralysed or the cardiac muscle and action are distinctly poor. In less severe cases, after a few weeks of a stationary condition, gradual improvement sets in, and after, perhaps, a year or more of partial paralysis, contractures, etc., complete recovery ensues.

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* *Journal of Nervous and Mental Diseases*, Dec., 1890.

† For a full account of this epidemic, the reader is referred to the *Encyclopædia Medica*, vol. viii., p. 301.

The **alcoholic** form is the most common. It occurs especially in women addicted to the secret, constant habit of spirit-drinking. The onset is usually gradual, and the nature of the case often obscure ; the pains and tingling of the feet and hands and tenderness of the muscles are often referred to rheumatism and neuralgia. The various degrees of loss of power usually begin in the feet and legs and extend to the hands and arms. The degree and extent of the muscular paralysis are very variable. The disturbances of sensation are also very variable in their degree, from mere numbness and tingling to severe burning and boring pains, great tenderness over the nerve-trunks, and soreness of the muscles when grasped. The hands and feet, when dependent, usually become congested and puffy. The feet and toes and the wrists and fingers are often "dropped," from loss of power of the extensor muscles. The deep reflexes are lost.

Mental symptoms, especially loss of memory in regard to time and place, hallucinations, and delirium are not infrequent in severe forms.

The prognosis is, as a rule, favourable; and, under suitable and protracted treatment, the muscles regain their power, and recovery is established.

Beri-beri is an endemic neuritis peculiar to certain parts of India, China, and Japan.

The **treatment** appropriate to these cases must vary according to their acuteness and severity. The *relief of pain*, which is often very severe in the acute forms, is the first indication. Absolute rest in a *comfortable* bed is essential. In alcoholic cases the alcohol should be wholly suppressed, and a nourishing light diet of milk, eggs, soups, light puddings, fish, pounded chicken, etc., should be prescribed. An abundance of fatty food, including cod-liver oil, is thought to be especially advantageous. Protracted warm baths are usually particularly soothing and grateful to the patient. Some recommend "rapidly alternating applications" to the limbs of very hot and very cold water. "A large sponge or soft towel is dipped first in very hot, and another in very cold water, and one is made to follow the other rapidly up and down the limb. If used properly, this makes an agreeable and useful method of local sedation or counter-irritation." Opium must not be given to relieve the pain unless absolutely necessary; we prefer antipyrin, phenacetin, and their congeners, but these drugs may fail to calm the nervous system to the same extent, and they all are, more or less, cardiac depressants. For the same reason we think cocaine should be avoided. General debility or cardiac asthenia may call for cinchona, quinine, strychnine, or digitalis.

Salicin and sodium salicylate certainly relieve the pain in many cases; but their continued use, in quickly repeated and large doses, not unfrequently produces the most serious conditions of cardiac debility. C. K. Mills recommends strongly the *oil of gaultheria* (methyl salicylate), in 10- to 15-minim doses, mixed with one or two tablespoonfuls of almond emulsion, or it may be given in capsules, 10 minims in each. The bromides and hyoscine may be needful in cases with cerebral excitement. It is extremely doubtful whether there is any form of multiple neuritis due to syphilis, but when cases have a recent history of infection they should be treated with mercurial inunction and potassium or sodium iodide. A combination of the latter with sodium bromide has been found useful. Malarial cases require full doses of quinine and arsenic. Lead cases require the alkaline iodides as eliminants. In arsenical cases they are also of service. Hypodermic injections of strychnine have been found valuable.

Drugs, however, cannot be said to have any influence in promoting the regeneration of the nerves; the efforts of the physician should be directed towards maintaining the muscles, tendons, joints, etc., in such a condition that the advent of re-innervation may find them capable of resuming their duties. Most important in this connection is the daily employment of passive movement to every joint in the affected limbs from the beginning of the illness, and the maintenance of the feet in a position at right angles to the legs by means of sand-bags, felt shoes, or any other simple device. These passive movements are resented by the patient on account of the pain they produce, but they must, nevertheless, be insisted upon, if contractures, calculated in the long run to cause infinitely more suffering and distress, are to be prevented from forming. In our experience it is the ignorance or neglect of this precaution in the nursing of cases of alcoholic neuritis that has been responsible for months of unnecessary suffering, surgical operations, etc.

Warm baths are of great value in most cases. *Massage*, at first of the gentlest kind, may be commenced as soon as the pains and tenderness have to a great extent subsided. In subacute and chronic cases massage, associated with galvanism, is of the greatest service. Inunctions, anodyne or remedial, may be combined with massage, such as weak aconitine ointment, mixed mercurial and belladonna ointments, or other suitable external applications. Swedish movements may, as the case progresses towards recovery, be added to massage. Electricity should be applied tentatively at first, and very weak currents used, and it should be discontinued for a time if the patient seems to be made worse by it.

ADDITIONAL FORMULÆ

Hypodermic injection of antipyrin for neuralgia

℞ Antipyrin, gr. lxxv.
Aquæ destillatæ, ʒijss.

M. f. injectio. A syringeful to be injected several times a day. (*Dujardin-Beaumetz.*)

For trigeminal neuralgia

℞ Veratrinæ, gr. iv.
Alcohol, ♏vj.
Adepis benzoati, gr. xcvj.

M. f. ung. "Veratrine ointment." (*Bartholow.*)

For Sciatica

℞ Extracti belladonnæ, gr. iv.
Extracti stramonii, gr. v.
Extracti cannabis indicæ, gr. vj.
Extracti aconiti, gr. viij.
Extracti opii, gr. xij.
Extracti hyoscyami, gr. xvj.
Extracti conii, gr. xxiv.
Pulveris extracti glycyrrhizæ, q.s.

Ut f. pil. xxiv. Two to five pills daily. (*Brown-Séquard.*)

Also

℞ Tincturæ radicis aconiti, ʒij.
Tincturæ seminum colchici, ʒij.
Tincturæ belladonnæ, ʒij.

M. f. tinct. Six drops every six hours until relieved. (*Metcalf.*)

For trigeminal neuralgia

℞ Butyl-chloral hydrate, ʒj.
Extracti cannabis indicæ, gr. jss.

M. et divide in pil. xij. One every three hours. (*Whitla.*)

For Sciatica

℞ Spiritus terebinthinæ, ℥ss.
Mellis puri, ℥jss.

M. f. confectio. A teaspoonful night and morning. (*Bamberger.*)

For trigeminal neuralgia

℞ Liquoris arsenicalis, ℥ss.
Aquæ destillatæ, ℥ss.

M. Five drops three times a day. (*Prof. Albert.*)

For dental neuralgia

℞ Tincturæ opii, ʒss.
Chloroformi, ʒss.
Creasoti puri, ʒss.
Tincturæ benzoini compositæ, ʒj.

M. f. tinct. To be applied to the cavity of the tooth on cotton-wool. (*Redier.*)

In periodical forms

℞ Quininæ sulphatis, ʒss.
Sacchari albi, ʒss.

M. et div. in pulv. vj. One or two to be taken before the expected attack. (*Bamberger.*)

Also

℞ Gummi asafœtidæ, gr. lxxv.
Extracti rhei, gr. xxx.
Extracti taraxaci, q.s.

Ut f. pil. lx. (To be silvered.) Two pills night and morning. (*Bamberger.*)

For trigeminal and other forms of neuralgia

℞ Sodii salicylatis, ʒiij.
Sodii iodidi, ʒj.
Syrupi simplicis, ℥j.
Aquæ ad ℥viij.

M. f. mist. A tablespoonful thrice daily. (*Prof. Benedikt.*)

In supra-orbital neuralgia

℞ Quininæ sulphatis, gr. v.
Morphinæ hydrochloridi, gr. $\frac{1}{6}$.
Ammonii chloridi, gr. xv.

M. f. pulv. A powder, wrapped up in moistened wafer paper, to be taken every six hours, after food. (*Whitla.*)

For facial neuralgia

℞ Butyl-chloral, gr. xv.
Glycerini, ℥j.
Syrupi simplicis, ʒvj.
Spiritus menthæ piperitæ, guttæ iij.
Aquæ ad ℥iv.

M. f. mist. A tablespoonful every two hours. (*Worms.*)

Hypodermic injection of ergotin for facial neuralgia

℞ Ergotini, ʒss.
Aquæ laurocerasi, ʒijss.
Glycerini, ʒijss.

M. f. injectio. Twenty minims for a dose. (*Marino.*)

For hysterical neuralgias, especially of the face

℞ Extracti gelsemii, gr. v.
Quininæ valerianatis, ʒss.
Zinci valerianatis, ʒss.
Ferri valerianatis, ʒss.

M. et divide in pil. xx. One thrice daily, after food. (*Whitla.*)

For sciatica and crural neuralgia

℞ Veratrinæ, gr. xx.
Vaselini, ℥j.

M. f. ung. To be rubbed in every other day. (*Prof. Albert.*)

For intercostal neuralgia

℞ Chloroformi, ʒvj.
Olei olivæ, ʒvj.
M. f. linim. For external application. (*Bamberger.*)

Also

℞ Veratrinæ, gr. iij.
Morphinæ hydrochloridi, gr. iij.
"Cold cream," ʒijss.
M. f. ung. A piece the size of a pea to be rubbed in over the painful nerve.
(*Bamberger.*)

For subcutaneous injection in trigeminal neuralgia

℞ Cocainæ, gr. jss.
Morphinæ sulphatis, gr. ¼.
Sodii chloridi, gr. ivss.
Aquæ ad ℥iij.
M. f. solut. (*Schleich.*)

For recent rheumatic neuralgias (sciatica, etc.)

℞ Phenacetin, gr. xl ad gr. lx.
Salol, gr. xl ad gr. lx.
Caffeinæ, gr. iv ad gr. vj.
Divide into 10 cachets. Take two to four daily. (*Domanski.*)

In rheumatic neuralgias

℞ Salophen, gr. xij ad gr. xl.
In cachets. Three to five cachets to be taken daily.
(*E. Koch.*)

Aconitine application for neuralgia

℞ Aconitinæ, gr. v.
Acidi oleici, ʒiv.
Olei lavand., ♏v.
M. f. oleatum. To be painted along the affected nerve.

CHAPTER IV

TREATMENT OF MIGRAINE AND OTHER HEADACHES; AND OF INSOMNIA

Migraine and other Headaches — *Migraine* or *Hemicrania* — Paroxysmal Character — Premonitory Symptoms — Visual Disturbances—Course of the Attacks—Treatment—In the Intervals — In the Paroxysms — *Anæmic Headache* — Its Characters — Its Treatment — *Neurasthenic Headache* — *Congestive Headache*—Indications for Treatment— *Toxæmic Headache*—*Sympathetic or Reflex Headache*.
Insomnia — Its Causes — Physical and Mental — Treatment of Different Forms—Various Hypnotic Agents.
Additional Formulæ.

MIGRAINE AND OTHER HEADACHES

DISCOMFORT about the head, or **headache**, of greater or less intensity, occurs in the course of most acute febrile conditions and in diseases attended with blood contamination, as in renal and other disease. Pain in the head also occurs, of necessity, in certain diseases of the bones of the skull or its coverings, as in syphilis and rheumatism, and also in certain processes within the cranium, as inflammation of the brain and its membranes, tumour, abscess, etc. But headache, as a necessary symptom of diseases such as these, forms part of the clinical characters of these affections themselves, and cannot well be considered apart from them therapeutically. It is needful, however, to point out that the existence of severe and *persistent* headache should always suggest the possible presence of serious intracranial disease, or disease of the cranial bones or coverings, and especially such as may be of a syphilitic nature. It is extremely important not to overlook cerebral syphilis as a possible cause of headache, as the adequate application of specific anti-syphilitic treatment will often rapidly dissipate symptoms of the most serious aspect. The co-existence of a localised paralysis, especially of the third nerve, will often suggest the syphilitic nature of severe and persistent headache.

But the headaches we are now about to consider are usually independent of the existence of acute or structural disease, and are mostly of temporary duration. The subject is a very complex one. We shall therefore, for the sake of clearness, begin by considering the most characteristic of these—viz. *migraine* headaches—and afterwards pass on to examine the mode of origin and treatment of other forms of this troublesome affection.

Megrim, **migraine,** or *hemicrania* is distinctly paroxysmal in its character. The attacks frequently recur at intervals of about three weeks or a month; in women the attacks have often been observed to occur about the menstrual period; but they may occur more frequently, even once or twice a week. Indiscretion in diet, working in overheated rooms, emotional excitement, overwork or worry, long railway journeys, or other disturbance or exhaustion of the system, will often determine the occurrence of an attack in the predisposed. Some warning of the attack is frequently felt, for a day or two before, in the shape of general depression, and slight headache or feeling of fulness in the head on getting up in the morning; or some dyspeptic symptoms may occur. In one of our own patients the attack is always ushered in by the passage of urine loaded with phosphates, and as the attack passes off the phosphates disappear and the urine throws down lithates abundantly. The disappearance of the phosphates and the appearance of lithates in the urine is always a sign that the attack is passing off. Some patients feel cold and chilly before an attack. In many the attacks not unfrequently commence with disturbances of *vision* (*ophthalmic migraine*). Bright spots of light, luminous zigzags or "fortifications," luminous scintillating circles, like "wheels of fireworks," and various other appearances, are described by different patients. Seeing only the half of things, hemiopia or hemianopsia, is not very uncommon, but more frequently there is merely a blurring of objects, the outlines of which appear indistinct. Curious visual hallucinations occasionally occur, and images of persons or animals are distinctly seen.

Severe pain, usually but not invariably confined to *one-half* the head, follows these premonitory symptoms. We have seen cases in which the ocular symptoms have alone occurred, followed simply by a slight feeling of fulness in the head. The face, pale at first, subsequently becomes flushed, and there is generally a complaint of nausea. In some instances the face remains pale. Light and noise are especially intolerable, and the patients naturally seek repose and quiet in a darkened room. Tingling and pricking are sometimes noticed in the fingers or hand and arm, and we have seen patients in whom the attack has commenced with tingling and pricking in the lips and tongue. Numbness of the right arm and leg, with temporary aphasia, has been observed to precede some attacks. The pain in the head is then on the *left* side. These disturbances of sensation do not, as a rule, last more than fifteen to twenty minutes. Curious coincident mental conditions have also been described, a sort of transitory insanity, excitement, confusion, or stupor, associated with hallucinations.*

The pain in the head is often excessively severe, and the nausea we have already referred to often ends in vomiting; hence the term "sick-headache." In some cases the vomiting is very distressing and aggravates the headache, but in many, after the vomiting, the headache begins to abate, the patient breaks into a perspiration, falls asleep, and awakes well. As a rule, the attack does not last more than twenty-four hours, and after a night's rest it passes away; but the severe forms sometimes last for two or three days.*

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* Sinkler: Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 569.

It is customary to say that the patients feel unusually well after an attack, but that is by no means always the case, and we have had occasion to observe much nervous shock, in neurotic subjects, after an attack, and particularly in those attacks in which there has been little or no headache, but only the sensory disturbances described.

This disease is frequently hereditary, especially in neuropathic families. It has been stated that direct heredity can be proved in 90 per cent. of the cases. It is also observed especially in the gouty.

The analogy this disease bears to epilepsy can hardly be overlooked; in both, the attacks are paroxysmal, with *auræ* preceding the attack and sleep ending it. There can be little doubt that there is some pathological relation between them.

The theory of *vascular spasm* is the one which seems most consistent with the phenomena of this disease, the spasm originating in some toxic condition of the blood acting upon a hyperæsthetic nervous area. This would account for the cerebral symptoms which precede the attacks of pain, and in some instances occur without the headache. Other vasomotor disturbances observed are probably the *effect* of the pain. The face is sometimes *flushed* and sometimes *pale*—or pale at first and subsequently flushed. It has also been noted that the temporal artery is sometimes dilated, and that its compression relieves the pain;† compression of the carotid has also been said to relieve the pain in some cases. May it not be that there is at first arterial spasm and partial cerebral anæmia, and that a *collateral* hyperæmia is chiefly concerned in causing the headache? For the source of the toxine we must probably look to defects in secreting and excreting functions, hepatic or other inadequacy, absorption of toxines originating in the alimentary canal, and which normally would be excreted. In this we see the relationship to gout.

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* Oppenheim has called attention to certain cases occurring in *neurasthenic* or *hysteric* persons, in whom, after they have suffered for a long time from *typical* attacks, these attacks become converted into a *permanent* form ("Diseases of Nervous System," p. 753).

† Mackenzie: Allbutt's "System of Medicine," vol. viii.

We may offer to the sufferers from this disease the consolation that it often disappears after middle age.

It has also been known to disappear after change of climate, after an attack of fever, and after an injury to the skull; but it is rarely entirely cured by treatment.

The **treatment** of this affection must depend greatly on the constitution and habits of the sufferer; that suitable to a robust gouty patient will not be altogether appropriate to an anæmic and neurotic subject. We will consider *first* the treatment in the intervals, and, *second*, the treatment of the paroxysms.

1. Careful attention to diet and regimen is essential in all cases; but we must not expect too much from this, as many sufferers from migraine are amongst the most abstemious. On the other hand, we have seen remarkable relief from the substitution of a purin-free dietary for an ordinary moderate fare. The gouty subject should avoid all dietetic excesses, and should take merely a sufficiency of the plainest and most digestible forms of food. He should avoid all malt liquors, sweet wines, or, indeed, wines of any kind; and if a stimulant seems needful, a very little sound brandy or whisky, with seltzer or Apollinaris water, should be taken. Regular exercise in the open air is advisable, and all overwork or worry should, if possible, be avoided. Frequent aperients are of great service, as such patients often learn for themselves, promoting as they do the elimination of *toxic* substances upon which the attacks may depend. A pill of aloes and henbane, containing also a grain of blue pill, at bed-time, with a dose of Carlsbad or Homburg salts in a tumblerful of hot water the following morning, is one of the best *preventives* of these attacks in the gouty.

We have seen gouty cases in which the attacks have been kept off by annual visits to Marienbad. It is in gouty and rheumatic subjects that a combination of sodium salicylate and sodium bromide answers so well. About 15 grains of each with half a dram of sal-volatile should be given at night during the intervals, and night and morning at the period of the attacks. If the sodium salicylate proves depressing, 10 grains of salicin and 10 grains of potassium bicarbonate may be substituted for it.

Oppenheim* maintains that *arsenic* is the drug of most value in this affection. He mentions a case in which the attacks were so severe that the patient threatened suicide, and all remedies proved useless until he prescribed the arsenical water of Levico, which cured him, and he rapidly gained 10 lbs. in weight. Arsenious acid ($\frac{1}{60}$ grain) may be given in a pill, after food, three times a day. The Levico water contains a considerable quantity of sulphate of iron as well as arsenious acid. Of very great value in a certain number of cases will be found the regular daily administration of nitro-glycerine, especially in cases associated with high arterial tension. One minim of the liquor trinitrini may be taken twice a day in a mixture over a long period of time with advantage. Chocolate tablets containing the same ingredient are equally useful.

Anæmic and neurotic patients will require a nourishing but simple diet, and will be benefited by iron tonics; but they usually require the mildest preparations of iron, such as the ammonio-citrate, which should be combined with an alkali and aromatic spirits of ammonia. The arsenate of iron, in pills of $\frac{1}{24}$ grain, after food, three times a day, we have also found useful. A course of iron waters at Schwalbach, Pyrmont, or Spa often proves of great service in these cases, due elimination by the bowels being, at the same time, carefully looked to. The advantages of regular aperients are almost as evident in these as in the gouty cases, and should never be neglected. Bamberger gives quinine in some of these cases, during the intervals, and a full dose of 4 or 5 grains at the onset of the attack. A modified course of *rest treatment* has been warmly commended in anæmic cases by some American physicians. A change of climate has often been found useful in these anæmic forms, such as a prolonged stay in dry, bracing, mountain air in some cases, and in seaside resorts in others, but patients should not reside close to the sea. Hydrotherapy, massage, and a rest cure may often be advantageously combined with change of air. A careful use of the bromides has proved, in our hands, very useful in warding off attacks, especially in those cases in which the sensory disturbances are chiefly complained of, and the subsequent headache is but slight. When the period of the return of an attack is well known, it is a good plan to begin giving the mixed bromides, in moderate doses, for three or four days before the attack is expected, and they will often be found to have the effect of greatly modifying its severity. We have found a combination of butyl-chloral (5 to 7 grains) and sodium bromide (10 to 20 grains) of remarkable efficacy in preventing the ocular disturbances.

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* "Diseases of the Nervous System," p. 755.

Many physicians are disposed to refer attacks of migraine to errors of refraction, which may be cured by *spectacles*. Glasses are no doubt of great service in some instances, and it is a good rule always to have a special examination of the eyes made for visual defects. But headaches dependent on errors of refraction hardly belong to this very definite class of paroxysmal headaches. For the same reason, cannabis indica, belladonna, and hyoscyamus have been advocated because of the sedative influence they exert on the third nerve and the muscles it supplies, including the iris. Cannabis indica, extolled by many, we have not found a very reliable drug. It is given alone, in doses of $\frac{1}{6}$ grain of the extract, cautiously increased; or in combination with arsenic and iron, or, in hyperæmic states, with ergot and nux vomica. It is usually given continuously for many months. Dr. Wharton Sinkler strongly advocates this treatment with cannabis indica. He gives it combined with arsenic and iron, or with digitalis and iron, or with nux vomica and ergotin.*

2. *For the attacks* we have found large doses of the bromides of service, and the combination of butyl-chloral and bromide already mentioned. The latter is of particular value in markedly neurotic subjects. *Antipyrin* and *phenacetin* are also of much efficacy in affording relief in the slighter attacks, and, if given early, in allaying the distress of the severe forms. We do not approve of the large doses of antipyrin prescribed and taken by many. We are satisfied that considerable impairment of cardiac tone follows its free use. Phenacetin we consider less objectionable. This latter drug may be given in cachets in doses of 3 to 10 grains, usefully combined, in many cases, with a few grains of quinine. Antipyrin may be given in 5- to 10-grain doses, taking care that not more than 30 grains are given in a day. We have found caffeine of great service in diminishing the severity of attacks, if taken at the commencement. It may be given in grain doses, mixed with a little sugar of milk, every half-hour, till 4 or 5 grains have been taken, or it may be given in larger dose (3 to 5 grains) with potassium bromide.

A drug, named by its introducer (*Oberlach*) *migranin*, has been extolled by Ewald as a remedy in this form of headache. It consists of antipyrin in combination with caffeine and citric acid. The dose is about 16 or 17 grains, to be repeated in half an hour if the pain is not relieved. Oppenheim does not think it "justifies its name." He has seen *pyramidon* do much good.

We have found *guarana* useful in many cases.

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 573. Sinkler's formulæ will be found, amongst others, at the end of this chapter.

Sinkler recommends 10 grains of guarana with 5 grains of sodium salicylate to be given every ten or fifteen minutes, until three or four doses have been taken; or 10 grains of sodium salicylate may be combined with a dessertspoonful of effervescing citrate of caffeine. Oppenheim finds a large dose of sodium salicylate (30 to 45 grains) in a cup of strong coffee often successful in the relief of the pain.

Many other drugs have been advised in this malady—and there can be no objection to giving them a trial—such as the hypodermic injection of hyoscyamin ($\frac{1}{50}$ grain); oil of eucalyptus in 5-minim capsules every half-hour for four doses; the fluid extract of ergot in dram doses every hour, if necessary, until three doses have been taken in cases with vascular relaxation, and nitro-glycerine has been found useful in the *angio-spastic* form;* aconitine, $\frac{1}{200}$ grain every hour; externally a cold compress may be applied to the head or a mustard plaster to the nape of the neck, and the feet put into a hot footbath. Mr. Walter Whitehead † has reported several very obstinate cases that have been cured by means of a seton. The seton must be worn uninterruptedly for three months in the first instance, and if the symptoms recur a second seton must be introduced. Most patients find that one of the best remedies is *rest in bed* in a darkened room, and that they can often "sleep off" an attack. Whatever remedies we employ, we should insist on rest as an auxiliary during the attacks.

Having considered the treatment of this *special* form of headache we must now return to the subject of headache in a *general* sense.

The successful treatment of headache must, of course, depend on our skill in ascertaining its true cause. The diagnosis of the form we have just been considering is usually easy on account of its very well marked characters, but in other forms it is not always easy to discover their true nature.

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* Thomson (*Journal of Nervous and Mental Diseases*, Feb., 1894) speaks highly of this remedy.

† *Brit. Med. Journal*, Feb. 9th, 1901, p. 335.

The chief influence in the causation of headache has been referred to *variations* in *intracranial* blood pressure resulting from vaso-motor disturbances, so that we may have headaches due to active hyperæmia and headaches due to anæmia; in the former we get severe throbbing pains in the head, with face flushed and eyes suffused, and often vertigo. Such headaches may be caused by mental strain, emotional excitement, alcoholism, excess of tobacco, etc., or the headache may be dependent on *venous* hyperæmia, as in chronic heart disease, pulmonary emphysema, and continuous cough.

Headache may also attend *anæmia*. In such cases there probably exists a hyperæsthetic condition of the nerves, together with the presence of some toxic substances in the blood due to defective elimination. This brings us to the next somewhat extensive group of cases, viz. those due to *auto-intoxication*, or *toxæmic* headaches. This group is a large one, and indeed it is not improbable that auto-intoxication may be a factor in the causation of most cases of headache. As instances of toxæmic headaches we may mention those due to dyspeptic conditions, to constipation, to hepatic and renal inadequacy, to diabetes, to rheumatism and gout, to fevers, to influenza and malaria. Then we have the group of *neurasthenic* and hysteric headaches; and finally those which are termed *reflex* or *sympathetic headaches;* amongst the latter are included the cases due to eye-strain, to errors of refraction and errors of accommodation, those due to disease in the oral, nasal, frontal, pharyngeal, and tympanic cavities, and those associated with uterine, ovarian, and sexual disturbances.

From the foregoing considerations it is clear that it is not always an easy matter to discover the original cause of a headache, and, as we have already said, the treatment of headaches is a complex subject, and to be successful it entails, as Oppenheim well observes, " a careful examination of the entire body, a minute dissection of all possible factors. . . . Symptoms of cerebral tumour, of cerebral syphilis, of meningitis, etc., must be sought after. The cranial cavities must be examined, the special senses tested. Errors of refraction must be corrected. The condition of the heart and vessels and of the urine may furnish important points."

We will now pass on to the consideration of the treatment appropriate to some of these groups, and first, of

Anæmic headaches.—Headaches occurring in women with the manifest symptoms of chlorosis and anæmia are described as *anæmic* headaches. In such cases there exists in all probability a special sensitiveness of the nervous system, together with some special defect in the action of the excreting glands induced by the anæmia ; so that there is not only a defective nutrition of the nervous tissues, but irritation of them by defective elimination of toxic substances. The pain of these headaches is usually more or less continuous, not paroxysmal ; although it suffers temporary aggravation and amelioration. The pain may be referred to the forehead, vertex or occiput, most commonly the vertex. It is usually increased by mental or bodily effort, and relieved by rest in the recumbent position. Disturbed digestion, constipation, depression of spirits, drowsiness by day, insomnia at night, dizziness, and various neurasthenic manifestations, tend to accompany this form of headache.

The **indications for treatment** are to restore the blood to its normal condition, to relieve digestive troubles, and to promote due elimination by aperients, and suitable exercise and regimen. Change to mountain air (the seaside aggravates the digestive troubles in some cases), with regulated exercise, careful feeding, and hydrotherapy, are of great service. The general principles which we have laid down for the treatment of anæmia and chlorosis apply to these cases, and will not be here repeated. Suitable aperients are always needed. Iron and arsenic are the best tonics; the milder preparations of iron are fittest. If there is notable cardiac weakness, coca, strychnine, and occasionally small doses of digitalis may be needed. Opium should be avoided; it will relieve pain, but it interferes with elimination, and its use is neither physiological nor rational. Nitroglycerine has been advised in doses of $\frac{1}{200}$ to $\frac{1}{150}$ grain; it may give temporary relief. Inhalations of oxygen and of nitrous oxide have also been recommended, and they may be tried in exceptionally severe and troublesome cases. In neurotic cases a pill of valerianate of zinc (1 grain) and phosphorus ($\frac{1}{60}$ grain) twice a day, if taken for a few weeks at a time, will often prove of great service. The syrup of the glycero-phosphates (Robin) has been of use in such cases. Treatment at a chalybeate spring, such as Schwalbach, attended as it necessarily is with rest and change, and plenty of fresh air, will be beneficial to many.

We should be very cautious how we encourage the use of alcohol in these cases; the relief it affords can only be temporary, and the craving for it we may excite may be permanent. Tea, coffee, guarana, are all safe and useful remedies. One or two small doses (5 grains) of antipyrin or phenacetin may, in some cases, be given to relieve very severe attacks. Insomnia is best treated by 10- to 20-grain doses of sodium bromide, together with tincture of hop in half-dram or dram doses.

Cannabis indica, chloral, amyl nitrite, and various other drugs have been recommended, but we have not found them trustworthy.

Neurasthenic headaches are closely allied to the preceding. The so-called "clavus hystericus" refers to a form of pain in the head (the vertex) compared to that caused by driving a nail into it. These cases, when anæmia is present, require the same kind of management as the preceding. The neurasthenia must be treated in the manner described in a subsequent chapter. Massage to the head will sometimes give great relief to such cases, and a course of hydrotherapy is very often of great service. In some of those cases in which it would not be practicable, or perhaps desirable, to carry out the complete Weir-Mitchell rest cure, a partial application of it has been suggested by its author, to be carried out as follows :—

On waking in the morning, a small cup of cocoa, then rest for twenty minutes ; then a sponge bath, the patient lying on a blanket, followed by brisk friction of the skin ; then dress, rest for twenty minutes, and breakfast ; after breakfast, one hour's rest ; 10 a.m., massage, and then an hour's rest. After each meal an hour's rest. Four or five glasses of milk should be taken during the course of the day, and 1 to 3 ounces of fluid extract of malt with each meal.

Drug habits are readily acquired by such patients, therefore drug treatment should be avoided as much as possible. When, however, owing to the acuteness of the pain, something must be given for its relief, the best remedy is antipyrin (5 grains) combined with caffeine (1 grain) every half-hour for four doses. A small cup of strong coffee with two teaspoonfuls of brandy will often give relief ; but we must be very cautious in the use of alcohol in these cases, as a craving for it is readily developed.

Congestive headaches may arise from various causes—from over-indulgence in food and drink ; from imperfect elimination and constipation in free livers ; from excessive mental labour and worry ; from pulmonary or cardiac conditions interfering with the venous return ; and from suppression of habitual discharges, as at the menopause, etc. These headaches are distinguished by pulsation and throbbing of the vessels of the head, flushing of the face, and over-full superficial veins ; by aggravation of the pain in the recumbent position ; and by giddiness, and visual and aural sensory disturbances. Digestive troubles are often present.

The **indications for treatment** are, *first*, to correct the habits of life on which the state may depend; *secondly*, to relieve, when possible, the circulatory disturbances which may cause the congestion; *thirdly*, to promote free elimination; *fourthly*, to give immediate relief to the overloaded vessels.

Sharp purging and the application of cold to the head in the form of an ice-cap will best fulfil the last indication. The application of leeches has been suggested, and so has compression of the carotids. Placing the feet and legs in hot mustard and water, or mustard plasters applied to the insides of the thighs (in women), are good derivatives. A mustard plaster to the nape of the neck is useful in some instances. In refractory cases a seton has been found useful. Oppenheim has "observed in some cases headache which had existed for years, often preventing the victim from working, completely disappear after the application of a seton." As has already been remarked, Mr. Whitehead, of Manchester, has also testified to the value of this measure in cases of migraine. A few doses of bromide are often valuable to allay cerebral excitement; but the therapeutic indications in this form of headache are causal, and we have little confidence in the use of analgesics. Most of these analgesic remedies have already been mentioned in the preceding sections, but it is clear they can only be palliative in cases such as we are now considering. Sodium salicylate will be found useful in gouty subjects. A spare diet, the avoidance of stimulants, free action of the bowels, regular exercise, removal from business worries or overwork (mental or physical), a life in the open air, and a course of mineral waters, such as Carlsbad, Marienbad, Tarasp, or Kissingen—these are the rational means for relieving such hyperæmic conditions.

Toxæmic headache is, in a partial sense, a term which might possibly be applied, with correctness, to nearly *all* forms of headache. The treatment of headaches associated with uræmia, malaria, plumbism, uricæmia, etc., cannot be considered, profitably, apart from the general conditions upon which they are dependent. To so-called *dyspeptic* or bilious headaches, which obviously belong to this group, the same remark applies; the rational treatment of the headache is the treatment of the morbid state on which it depends. To refer all or nearly all headaches to uricæmia, as one author does,* and to treat them by abstention from animal food and the administration of salicylates, is not in accordance with our experience. Cholagogue aperients are undoubtedly of great service in the treatment of these headaches, as they very effectually promote the elimination of the toxic substances which excite them. Headaches dependent on gouty, rheumatic, or syphilitic *periostitis* will be relieved by potassium iodide, but this drug will often need to be given in large doses up to 20 or 30 grains thrice daily. It may be combined with nux vomica and sal-volatile to counteract its depressing effect.

The treatment of *sympathetic* or *reflex* headaches will usually fall into the hands of the specialist. Those dependent on disorders of the sexual organs, of the uterus and ovaries, will be cared for by the gynæcologists. Headaches taking their start from carious teeth must be remedied by the dentist. Those—and they are numerous—dependent on ocular disturbances will require the aid of the ophthalmologist.

Nasal and *aural* specialists assure us that many cases of obstinate headache arise from disease of these cavities. The most common cause, we are told, is the presence of *adenoid* vegetations in the naso-pharynx, and with their removal the headache disappears. *Hypertrophy* of the *middle turbinated body*, it is stated, is another frequent cause, and intense headaches are reported to have been cured by "resection of the bulk of the middle turbinated bodies."

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* *Brit. Med. Journal*, Nov. 4th, 1899, p. 1247.

Clearing out and disinfecting the frontal sinus; irrigation for empyema of the frontal sinus; opening of the ethmoidal and sphenoidal cells; puncture and irrigation for empyema of the antrum; all these operations have been reported as attended by relief of otherwise incurable headaches.*

Aural surgeons also report the cure of distressing headaches by suitable operations on the aural cavity.

INSOMNIA

Of the intimate nature of sleep, as a function of the brain, or of the precise changes in the brain upon which it is dependent, we have no accurate knowledge. It is difficult, therefore, to approach the subject of the remedial management of loss of sleep from a scientific standpoint. We know, however, many of the conditions, physical and mental, upon which the loss of sleep commonly depends, and we may hope that, in many instances, our efforts to remove or antagonise these conditions may result in its restoration.

We must especially recognise, in different individuals, great differences in what we may term **cerebral stability.** A slight irritation will suffice to produce cerebral instability and agitation in one individual, with consequent loss of sleep, which would be quite inadequate to induce any such disturbance in others. Most persons who have been distinguished by the faculty of great physical and mental endurance, and the power of sustained mental effort, have also been endowed with great cerebral stability. Great efforts may leave them with an exhausted brain, but with no great disturbance of its stability. In others, less happily endowed, mental efforts leave the brain not only exhausted, but irritated and unstable. The faculty, therefore, of resting and sleeping well often, but not always, goes with the faculty of working well. A peculiar, and often inherited, hyper-sensitiveness or instability of the nervous system lies at the root of habits of sleeplessness in many cases; hence it is in the neuropathic and the hysterical that we find the most troublesome examples of this condition.

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* *Brit. Med. Journal,* Nov. 4th, 1899, p. 1243.

In considering the exciting causes of insomnia we may divide them broadly into *physical*, *mental*, and a combination of the two.

Amongst the *physical* we should enumerate—(1) *physical pain*, or discomfort arising from injuries, diseases, or simply irritation of bodily organs; (2) the brain excitement developed during the action of the poisons of fevers and infective and other diseases; (3) the disturbances of brain function dependent on structural brain disease; (4) certain ingesta which, directly or indirectly, disturb that cerebral calm and stability which is necessary to sleep. We might separate a group or class of these physical agents and apply the term *toxic* to the group, which would be a somewhat ill-defined one.

We might divide the *mental* into intellectual and emotional disturbances, although in many cases they are inseparable. Excessive intellectual efforts, when they lead to cerebral instability and irritation, are frequently associated with emotional influences; as the anxiety of competition, the struggle for some uncertain end, or object, or the consciousness or dread of incapacity.

Emotional disturbances form the basis of the great majority of cases of insomnia—the passions of grief, anxiety, love, and the suspense and worries inseparable from social life.

It is clear that in this last class of cases our efforts to minister to their relief must often be attended with unsatisfactory results.

In *neurasthenic* states we usually encounter a combination of mental and physical agencies cooperating in disturbing brain stability.

The successful **treatment** of sleeplessness necessitates a careful investigation into the conditions which have given rise to it.

We will here refer, in the first place, to the management of those cases of insomnia dependent on the ingestion of certain articles of food and drink, or on certain **food habits**, into which we should carefully inquire. A very common and remediable cause of sleeplessness is the existence of some food habit which causes a disturbance of that physical and organic calm, at the hour of retiring to rest, which is needful, in the hyper-sensitive, in order to ensure sleep. The consumption of *cardiac excitants*, such as tea, coffee, and, with some persons, tobacco and alcohol, late at night, will sometimes effectually prevent sleep by the circulatory disturbances produced; yet, in the sleeplessness caused by over-fatigue, tea or coffee will often promote sleep by its restorative effect on the nervous system. The excitement of digestive activity, or the disturbance of gastric function caused by taking a full meal late in the day, especially in persons prone to dyspepsia, is a frequent cause of insomnia. Flatulent distension of the stomach, the irritation of gastric acidity, the upward pressure on the heart, and the palpitation thus excited, due to such improper habits of feeding, give rise to sleeplessness, which will be avoided by adopting different habits.

In cases of acid dyspepsia and flatulence, even without the existence of the habits referred to, sleeplessness may often be prevented by drinking a tumblerful of hot water in which 10 to 30 grains of sodium bicarbonate is dissolved, a quarter of an hour before bed-time. We have found this a valuable expedient, in many cases, where gastric acidity was not suspected to be the cause of the insomnia.

Habitual constipation, when it is attended with flatulent distension of the intestines, will often cause sleeplessness from the discomfort arising from the upward pressure of the distended intestines on lying down in bed. The remedy for this is the removal of the habit of constipation. An enema of 12 to 16 ounces of warm soap and water with 3 or 4 tablespoonfuls of olive oil, taken an hour before bed-time in such cases, will often prevent a sleepless night. If the first enema does not act satisfactorily a second may be given.

Exhaustion from insufficient food is occasionally a cause of insomnia. When this is the case the consumption of a little light, nourishing food, with a small quantity of some suitable stimulant, such as a teacupful of beef-tea or gruel or arrowroot with a dessertspoonful of brandy, before retiring to rest, will cure the sleeplessness.

Persons of studious habits, who work late in the evening and find they cannot sleep on retiring to bed, should discontinue their work about an hour before bed-time and take some out-of-door exercise or read some light literature before going to rest. It is most desirable to avoid any possible cause of excitement or worry at bed-time, such as reading sensational books, hearing exciting news, or reading letters on business, etc. To be the *sole* occupant of a cool and quiet bedroom is sometimes of much importance.

Often some quite minor physical discomfort will start the habit of sleeplessness, such as insufficient warmth in bed ; or the contrary, too great heat of the bed ; but particularly *cold feet* in bed. When the latter is the case, the remedy is to bathe the feet in hot mustard and water just before going to bed, dry them with smart friction, and put on well-warmed woollen socks for night wear.

A hot bath, by its action in restoring normal arterial tension, has been found of great use in many cases, and especially in cases of great mental excitement.

Massage, especially of the abdomen and lower extremities, will often induce sleep, possibly by diverting the blood to the vessels of those parts. We knew a medical man who was greatly troubled with insomnia until he tried general massage, and fell asleep during the process.

The methods of *hydrotherapy* are often successful in restoring sleep to the sleepless ; but they are best carried out in an institution for the purpose, under a physician skilled in their application, as they require careful modification for individual cases.

In cases of nerve exhaustion, the application of electricity has proved useful. Jacoby* says he has known the "*head breeze*" in neurasthenic insomnia succeed "when all other remedies and all other forms of electric application have failed." Occasionally some very simple remedy will succeed. The late Dr. Elliotson said "he knew a lady who often remained awake in spite of everything, until her husband very gently rubbed her foot"!

But, too frequently, the treatment of insomnia resolves itself into the employment of some sedative or hypnotic drug, and the important point is to select that which will be the least harmful, and the least likely to establish an undesirable habit, and, above all, not to have recourse to it until all other measures have failed. We are not, of course, thinking of *acute* forms of insomnia, when a thoroughly reliable hypnotic may be an immediate necessity.

When the need of a narcotic is obviously temporary only, as for the relief of physical pain, after surgical operations, or in the course of acute or other disease, we need have no hesitation in giving it; but it is quite otherwise when we are dealing with the subjects of habitual insomnia, who too often develop a craving for sleep-procuring drugs, and who cannot be trusted to use them cautiously and occasionally.

It is often needful to distinguish between true nervous exhaustion from overwork and mental strain, and insomnia in persons of naturally weak and irritable nervous systems; hypnotics may be given to the former without much risk, but not to the latter.

Alcohol has a well-known power of inducing sleep, and if we could be sure that there was no danger of producing the habit of alcoholic indulgence, we might find in it one of the best of narcotics. But, except in large quantities, it has little influence over obstinate cases. In slight cases, however, a glass of bitter ale or stout at bed-time, or a tablespoonful or two of sound whisky with hot water, will frequently have the effect of inducing sleep. It probably acts by promoting dilatation of the vessels of the surface and establishing normal vascular tension. In other cases we have found 1 or 2 drams of tincture of hop in an ounce or two of some aromatic water, at bed-time, answer well. It is often advisable, in giving alcohol to procure sleep, to give it half an hour or an hour before bed-time, so as to allow the preliminary excitement of its action to pass away.

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* Cohen's "System of Physiologic Therapeutics," vol. ii., p. 191.

The value of *opium* for the relief of the insomnia due to *painful* disease is well known, and we have only to say here that it is, of all the means at our disposal, the least desirable for the relief of the chronic *habitual* cases we are now considering; but when sleeplessness is caused by *acute physical pain* some preparation of opium or morphine will be necessary to procure sleep.

The least objectionable of hypnotics for the relief of simple insomnia are the *bromides*, and the sodium bromide is the best for this purpose. It may be given in doses of from 10 to 30 grains in an ounce of chloroform water, or it may be combined with a dram or two of tincture of hop. This dose is of great value in the slighter emotional cases, and in many conditions of mental irritability. It is a good plan, in such cases, to give two or three doses of bromide during the day also. In cases of insomnia merely due to mental over-activity the bromides given in this way are all that is needed.

Chloral is a very certain hypnotic, and is of immense service when it is of great importance to procure sleep quickly, and so avoid grave cerebral exhaustion from protracted sleeplessness; but it has the disadvantage of being a cardiac depressant and a gastric irritant, and the habit of chloral-taking may be quickly indeed. It should be reserved for occasional, not habitual, use, and for acute and not chronic cases; and it should be always given combined with about an equal quantity of bromide of sodium or potassium; much smaller doses are then needed, and unpleasant after-effects are avoided. Fifteen grains will often suffice.

Chloralamide is a drug which is now used largely in the place of chloral, and it is regarded as a safer, though somewhat less powerful, hypnotic. The dose is 30 to 60 grains; and, as the taste is disagreeable, it is best given in capsules, or in solution with some aromatic tincture. It is less prone to cause gastric irritation than chloral. Prof. R. W. Wilcox* has found it "the safest of the hypnotics for the insomnia of patients suffering from cardiac disease," and "particularly useful in the insomnia resulting from excessive mental activity."

Sulphonal and *trional* are, however, the most popular and, perhaps, the safest of the modern hypnotics. It should be remembered that *sulphonal* is somewhat slow in producing its soporific effect, and it should be taken some time before sleep is desired. If taken on going to bed, it may be some hours in acting, and the patient may suffer from sleepiness the whole of the next day. Its soporific action has been observed to extend to the next night. This is an advantage in many cases, and for this reason it has been advised that it should only be administered on alternate nights. Indeed, its use should always be interrupted after a short time to allow of its *complete elimination*, which may be aided by aperients. Its combination with potassium bromide may be warmly commended; 10 to 20 grains of sulphonal with 20 grains of bromide in a cup of warm broth, milk, or chocolate should be taken two or three hours before bed-time. Another method of giving sulphonal, which has been found useful, is to give half the dose (7½ to 10 grains) about an hour before late dinner, and the other half at bed-time. (This is a good plan with persons who wake up about 2 or 3 a.m. and cannot go to sleep again, a type of insomnia observed in the gouty and also in those who smoke late at night.) If dissolved in boiling water, it is found to act more quickly. Some have prescribed it mixed with whisky-punch. Some serious symptoms have been observed occasionally to follow the prolonged use of sulphonal, such as peripheral neuritis, headaches, nausea and vomiting, and, most serious of all, the occurrence in the urine of hæmato-porphyrin, attended by abdominal pain, vomiting, and fatal collapse. The habitual use of this drug should therefore be strongly discouraged.

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* *Brit. Med. Journal*, Oct. 7th, 1897, p. 857.

Trional has the advantage over sulphonal of being more soluble, and its action is therefore more rapid, inducing sleep in from ten to twenty minutes. It is rarely that any unpleasant effects on waking follow its use. Like sulphonal, it should be given in some *hot* fluid (broth, milk, etc.), in which it dissolves more readily.* The dose is 10 to 30 grains. It should not be given for more than five or six consecutive nights, and it is advisable to give some alkali during the day (20 to 30 grains of sodium bicarbonate) to avoid hyper-acidity of urine, which is apt to arise, as with sulphonal, from the action of the hypnotic on the blood globules. The bowels should also be kept open, so as to promote elimination of the drug.

Tetronal has much the same properties as its congener, trional, over which it has no particular advantage. The dose and mode of administration are the same.

Chloralose is not of much value in ordinary cases of insomnia, but is most useful for those who are unable to sleep while travelling on sea or land. In addition to having a specific action against sea or train sickness it conduces to rest and sleep under these conditions. Care must be exercised in obtaining reliable samples of the drug, and in not taking more than 5 grains at a time, and not at smaller intervals than six or eight hours. In larger doses it is liable to give rise to serious symptoms of intoxication strongly resembling those produced by alcohol.

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* A form, recently recommended, of prescribing trional will be found amongst the additional formulæ at the end of the chapter.

Paraldehyde is a valuable hypnotic and free from unpleasant after-effects, except that of imparting a most disagreeable odour to the breath, which greatly interferes with its general adoption. Some physicians, however, regard this as an advantage, as it tends to prevent its *habitual* use. It is given in doses of ½ dram to 2 drams, and usually acts with rapidity.

Hyoscyamus and the alkaloids *hyoscine* and *hyoscyamine* are found most valuable hypnotics in cases of mental excitement in the insane, and we have also found a combination of bromides and tincture of hyoscyamus answer better than other hypnotics in the insomnia of chronic alcoholism.

Chloroform and *ether* inhalations are reserved for those cases of sleeplessness associated with some spasmodic affection which the anæsthetic allays.

In certain cases of insomnia with feeble heart and low arterial tension it has been found that the strengthening of the heart by *digitalis* or *strychnine* has restored the power of sleeping. It is necessary, therefore, in all such cases to attend carefully to the character of the pulse.

Hypnotism has been suggested for the relief and cure of insomnia, but it is a method of which we have a profound mistrust, surrounded as it is with subtle dangers, and it has failed conspicuously in the cases in which we have seen it applied. It is only right to add that Bradbury * thinks it a valuable therapeutic agent.

Formulæ for the administration of the chief hypnotics will be found amongst those appended to this chapter. The most difficult cases to deal with are those dependent on some far-reaching emotional disturbance. For these, travel, change of climate, change of life (especially a life in the open air), hydrotherapy combined with massage and electricity, are the best remedial measures; and drug treatment is probably the worst. As to *climate*, living in the open air in woodland districts of moderate elevation seems most conducive to the restoration of sleep. "An outing under canvas in the northern woods of Canada is a sleep producer of the most remarkable kind. I have seen men haunted for years by the demon insomnia go to these woods, and while there develop a sound sleep habit which added years to their life."* The air at the seaside and at high altitudes proves too exciting to some sleepless patients.

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* Allbutt's "System of Medicine," vol. vii., p. 756.

The treatment of neurasthenic cases is further dealt with in a subsequent chapter.

In conclusion, we would earnestly impress on all who have to deal with this troublesome condition the great importance of avoiding having recourse to hypnotic drugs except in cases of urgent necessity. But in cases of great and sudden mental or emotional disturbance, causing absolute sleeplessness, it is necessary to give a thoroughly effective and full dose of a reliable hypnotic to compel sleep, and so save serious nerve strain. Where there is no cardiac weakness a single full dose of chloral and bromide should be given at night, and two or three doses of bromide during the day. But in less urgent cases there are many other resources, as we have pointed out, for dealing with this state; and these, if judiciously urged, and combined with a little patience, will often succeed in overcoming this habit without inducing another, which is perhaps a greater evil—the habit of taking narcotic drugs.

The treatment of the insomnia dependent on acute or organic diseases, fevers, cardiac, renal, pulmonary and other diseases is considered in the chapters dealing with these affections.

It should be remembered that in chronic forms of insomnia, where hypnotics may be needed for long periods, it is very advisable to vary the drugs used.

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* Professor C. K. Clarke, *Brit. Med. Journal*, Oct. 2nd. 1897, p. 854.

A LIST OF OTHER *HYPNOTICS*, WITH BRIEF COMMENTS

Amylene hydrate.—Dose, 30 to 80 minims in some flavouring medium. Intermediate in action between chloral and paraldehyde.

Apomorphine.—Reported to be a prompt and effective hypnotic in doses of about $\frac{1}{30}$th grain, hypodermically, *i.e.* a much smaller dose than that needed to produce emesis. It has been found to produce refreshing sleep in 25 minutes, and to leave no disagreeable after-effects. Its emetic action in large doses quite prevents the formation of a "drug-habit." Useful in delirium cases.

Butyl-chloral hydras.—Dose, 5 to 20 grains in glycerine and water. Will frequently relieve the insomnia due to neuralgia of the fifth nerve.

Camphor monobromide.—Dose, 2 to 10 grains in pills with curd soap and proof spirit. Hypnotic in the insomnia of convulsive diseases.

Cannabis indica; Cannabin tannate; Cannabinon.—Dose of the extract, gr. $\frac{1}{4}$ to gr. j.; of the tincture, 5 to 15 minims. The inconstancy in the composition of its preparations, and the consequent uncertainty in action, are great drawbacks to their use. They also sometimes produce excitement. Cannabin tannate, dose 4 to 8 gr. in pill or in weak alkaline solution, and Cannabinon, dose gr. $\frac{1}{4}$ to gr. j., have been found useful in the insomnia of the nervous and hysterical.

Chloretone.—Dose, gr. 5 to gr. 25 in a cachet, followed by a draught of water. Not very reliable. Is useful under the same conditions as chloralose.

Chlorobrom is a speciality containing chloralamide and potassium bromide, 30 gr. of each to the ounce; dose, $\frac{1}{2}$ oz. to 1 oz. Its prolonged use is said to be well tolerated.

Dormiol (amylene-chloral).—Usually given in capsules containing 7½ minims, 1 to 5 for a dose. Said to be a powerful hypnotic, but not much is known as to its after-effects.

Hedonal.—Dose, 15 to 45 grains in a cachet. Said to be an "improved urethane," and to have the advantage over chloral and trional of being harmless. In the insane large doses are needed (up to 90 grains) to produce any effect. It may be described as a mild and harmless hypnotic in cases of simple insomnia.

Hypnal.—Dose, 15 grains in a cachet. A combination of antipyrin and chloral, and having the same properties as its constituents.

Lupulin.—Dose, 2 to 5 grains in a pill. A mild hypnotic; often given in alcoholic cases.

Metaldehyde.—Dose, 2 to 8 grains in cachets or pills. Has been found a useful hypnotic.

Methylal.—Dose, 15 to 30 minims with syrup and water. A hypnotic which is reported not to depress the heart's action.

Pellotine.—Dose, gr. ⅓ to gr. j. An alkaloid obtained from a cactus growing in America. The chloride is soluble in water, and can be administered hypodermically. It has been well spoken of as a safe hypnotic by Prof. R. W. Wilcox, of New York, but at present it cannot be said to have established any claim to general use.

Piscidia (Jamaica dogwood).—Dose of liquid extract, ½ a dram to 2 drams. Reported to be an effective substitute for opium, relieving pain and inducing sleep without causing undesirable after-effects.

Uralium or *Ural.*—Dose, 15 to 45 grains. A combination of urethane and chloral. Uncertain in its action and attended with disagreeable after-effects.

Urethane.—Dose 10 to 60 grains. Advocated in the insomnia of cardiac disease, but very uncertain in its effects.

ADDITIONAL FORMULÆ

For migraine

℞ Sodii salicylatis, gr. xlv.
Sacchari lactis, gr. xxx.

M. et divide in pulv. vj. A powder every hour at the time of the attack.

(*Bamberger.*)

Another

℞ Caffeinæ bromhydratis, gr. xv.
Quininæ bisulphatis, gr. xxij.
Sacchari albi, gr. xxx.
Olei menthæ piperitæ, gutta j.

M. et divide in pulv. x. Three to be taken in the day.

(*Bamberger.*)

Aperient pills in migraine

℞ Quininæ sulphatis, gr. xv ad gr. xxx.
Extracti aloes aquosi, gr. lxxv.
Pulveris et extracti glycyrrhizæ, q.s.

Ut f. pil. lx. Two night and morning. (*Bamberger.*)

For migraine

℞ Phenazoni (antipyrin), ʒjss.
Potassii bromidi, ʒiv.
Spiritus chloroformi, ʒij.
Aquæ camphoræ ad ℥viij.

M. f. mist. A large tablespoonful when the attack comes on, and a dessertspoonful every morning and evening between the attacks. (*Whitla.*)

For headaches

℞ Sodii salicylatis, gr. xv.
Potassii bromidi, gr. x.
Spiritus ammoniæ aromatici, ʒss.
Aquæ ad ℥j.

M. f. haust. To be taken three times a day. (*Brunton.*)

For migraine

℞ Quininæ sulphatis, gr. xv.
Caffeinæ citratis, gr. xv.

M. et divide in pulv. vj. One for a dose during the attack. (*Benedikt.*)

In the intervals

℞ Sodii bromidi, ʒv.

Divide in pulv. xx. Take one night and morning.

(*Benedikt.*)

Pills to be taken in the intervals of attacks of migraine

℞ Sodii arsenatis, gr. ij.
Extracti cannabis indicæ, gr. iv.
Extracti belladonnæ, gr. viij.
Zinci valerianatis, gr. xlviij.

M. et divide in pil. xxiv. One to be taken after breakfast and dinner. (*Little.*)

For the same

℞ Extracti cannabis indicæ, gr. $\frac{1}{6}$.
Extracti nucis vomicæ, gr. $\frac{1}{4}$.
Ergotini, gr. j.

M. f. pil. To be taken three times a day after meals.

Or

℞ Extracti cannabis indicæ, gr. $\frac{1}{6}$.
Pulveris digitalis, gr. ss.
Ferri lactatis, gr. ij.

M. f. pil. To be taken three times a day after meals.

Or

℞ Extracti cannabis indicæ, gr. $\frac{1}{6}$.
Acidi arseniosi, gr. $\frac{1}{60}$.
Ferri pulveris, gr. j.

M. f. pil. One three times a day, and may be increased to two or even three thrice daily.

(This and the above are intended for prolonged administration.)

(*Prof. Wharton Sinkler.*)

For migraine and ocular migraine

℞ Butyl-chloral hydratis, gr. xxx.
Potassii bromidi, gr. lx.
Glycerini, ʒiv.
Syrupi aurantii, ℥j.
Aquæ ad ℥vj.

M. f. mist. Two tablespoonfuls for a dose. (*J. B. Y.*)

Caffeine mixture for migraine

Caffeinæ, gr. xxxvi.
Sodii salicylatis, gr. lx.
Syrupi floris aurantii, ℥j.
Aquæ ad ℥vj.

M. f. mist. One tablespoonful for a dose. (*J. B. Y.*)

For syphilitic headaches

℞ Sodii iodidi, ʒjss.
Morphinæ hydrochloridi, gr. jss ad gr. ij.
Extracti et pulveris glycyrrhizæ, q.s.

Ut f. pil. lx. Four pills night and morning (to be kept in orris powder).

And

℞ Hydrargyri perchloridi, gr. jss.
Sodii chloridi, gr. ix.
Aquæ, ℥ijss.

M. f. solutio. For hypodermic injection, dose about five minims. (*Benedikt.*)

For sympathetic headache of ovarian disease

℞ Ammonii bromidi, ʒvj.
Extracti hydrastis fluidi, ℥ss.
Tincturæ gentianæ compositæ, ℥jss.
Aquæ, ℥iv.

M. f. mist. A dessertspoonful three times a day. (*Sinkler.*)

For hysterical headaches

℞ Zinci valerianatis, gr. xij ad gr. xxiv.
Extracti belladonnæ, gr. iij ad gr. v.
Extracti gentianæ, gr. xxiv.

M. et divide in pil. xij. One three times a day. (*Tanner.*)

For nervous headache

℞ Tincturæ hyoscyami, ℥ss.
Spiritus ammoniæ aromatici, ℥ss.
Syrupi aurantii, ℥j.
Aquæ menthæ piperitæ, ℥ij.

M. f. mist. A tablespoonful for a dose, with water. (*Wright.*)

For insomnia at the menopause

℞ Potassii bromidi, gr. xx.
Tincturæ sumbulis, ʒss.
Tincturæ lupuli, ʒj.
Aquæ camphoræ ad ℥j.

M. f. haust. At bed-time. (*Bradbury.*)

In simple insomnia

℞ Lupulini, gr. iij.
Camphoræ, gr. iij.
Extracti hyoscyami, gr. iij.

M. et f. pil. ij. To be taken at bed-time. (*Steward.*)

Or

℞ Tincturæ lupuli, ʒj ad ʒij.
Sodii bromidi, gr. xv.
Aquæ chloroformi ad ℥jss.

M. f. haust. To be taken at bed-time.

For insomnia with flatulent dyspepsia

℞ Sodii bicarbonatis, gr. xx.
Spiritus ammoniæ aromatici, ʒss.
Spiritus chloroformi, ♏xx.
Aquæ menthæ piperitæ ad ℥jss.

M. f. haust. To be taken at bed-time with an equal quantity of hot water.

Insomnia with mental excitement

℞ Hyoscine hydrobromidi, gr. $\frac{1}{200}$ to $\frac{1}{100}$.

To be administered hypodermically.

Elixir of paraldehyde for insomnia

℞ Paraldehyde, ʒijss.
Tincturæ vanillæ, ʒss.
Spiritus vini rectificati, ℥jss.
Aquæ destillatæ, ℥iij.
Syrupi simplicis ad ℥v.

M. f. elixir. One or two tablespoonfuls for a dose.

(*Yvon.*)

A hypnotic draught

℞ Chloral hydratis, ʒss.
Potassii bromidi, ʒss.
Liquoris morphinæ bimeconatis, ♏xxx.
Syrupi aurantii floris, ℥ss.
Aquæ destillatæ ad ℥iij.

M. f. haust. Half to be taken at bed-time, and the remainder in three hours, if necessary.

(*Whitla.*)

Formula for trional

Trional, 15 grains.
Oil of sweet almonds, 5 drams.
Sugar, 2 drams.
Gum arabic } āā 3 gr.
Gum tragacanth }
Orange flower water, 2½ drams.
Cherry laurel water, ½ dram.

Make an emulsion. To be taken in water or milk.

The trional dissolves in the oil, and given in this way we avoid the inconveniences dependent on its sparing solubility in water.

Or it may be given as an enema, thus:—

Trional, 10 grains.
Oil, 4 drams.
Yolk of egg, 1.
Water, 5 ounces

Mix.

CHAPTER V

TREATMENT OF CHOREA AND OF PARALYSIS AGITANS

Chorea, its Nature and Characteristic Symptoms—Causation—Relation to Acute Rheumatism and Endocarditis—to Emotional States—Microbic Theory—Influence of Educational Strain—*Treatment*—Rest and Food—Drugs—Aspirin—Salicylates—Arsenic—Rest Cure—Baths and Douches—Gymnastics — Massage — Electricity — Quinine — Strychnine — Zinc Compounds—Sedatives and Hypnotics—Cimicifuga—Conium—Hyoscine—Bromides and Chloral — Chloralamide — Morphine — Chloroform Inhalation — The "Wet Pack"—Ether Spray—Generalities.

Paralysis Agitans — An Incurable Disease — Its Causation — Symptoms and Clinical Features — Course — *Treatment* — Avoidance of Excitement—Electricity—Massage—Rubbing—Tonics and Sedatives—Passive Movements and Carriage Exercise in Open Air. Additional Formulæ.

CHOREA is a disease of **early life** the pathogeny of which is still involved in obscurity. It has been described as a form of functional exhaustion of the central nervous system, associated with vascular disturbances affecting the motor tract in the brain and spinal cord. It would seem, however, to be rather a morbid *irritability* or excitement of the motor centres, which no doubt may lead eventually to functional exhaustion.

It is readily distinguished by its highly characteristic **symptoms**, the chief of which depend on frequent, irregular, involuntary movements of various groups of muscles, especially those of the arms, legs, face, and tongue, and in some cases the muscles of the trunk also. The irregular action of these muscles causes the arms and hands to move about in an odd, purposeless fashion ; the legs and feet also keep moving and shifting their position ; the facial muscles by their irregular contractions give rise to all kinds of grimaces and gestures; the tongue is suddenly protruded and retracted, without any object, and the eyes are rolled about, and the head turned from side to side. When the muscles of the trunk are also involved, as is the case in severe forms, the whole body may be moved and tossed about in bed, so that the elbows and other bony prominences get bruised and excoriated. It often happens that the choreic movements are at the onset almost, if not quite, limited to one side of the body (hemichorea). Even in the slighter cases all voluntary movements are carried out feebly and often perverted by the uncontrollable irregular actions of the muscles. The power of speech is lost or greatly interfered with in all but the slighter cases. There is usually considerable loss of voluntary power as well as much restlessness and sleeplessness, and these symptoms may become so pronounced as to be of serious import, and, combined with violent muscular movements, may lead to a fatal result from exhaustion. Considerable emaciation from inability to take food occurs in these graver forms. These irregular involuntary movements usually cease during sleep, and from this circumstance it has been inferred that the motor excitement or disturbance must be cerebral and not spinal. It is almost exclusively a disease of *early* life, and is especially prone to occur between the ages of 5 and 15. It is extremely rare after 20. It is most common at the age of 13. It is also far more common in girls than boys. Osler's statistics, which accord fairly with those of other observers, give girls 71 per cent. and boys 29 per cent.

Chorea is very frequently associated with the existence of **cardiac murmurs**, especially a systolic murmur over the mitral area, and although in some cases, doubtless, these murmurs may be functional and hæmic, yet there seems good reason for believing they are more commonly caused by co-existing or pre-existing endocarditis, and that they indicate mitral incompetence.

The undoubted frequency with which chorea is associated with endocarditis, combined with the fact that a large proportion of the victims of the former disease display at some time one or other of the manifestations of the rheumatic diathesis, has led to the view that acute rheumatism and chorea have more than an accidental relationship to one another. It has been shown statistically that rheumatic arthritis not only often precedes, but often follows, at varying intervals, an attack of chorea, and still more recently a bacteriological association between the two diseases has been suggested by the researches of Poynton and Holmes. The latter were able to demonstrate in the brains of fatal cases of chorea the presence of a diplococcus similar to that which has often been found in cases of rheumatic arthritis and endocarditis.

The idea that chorea may be determined by emboli from diseased cardiac valves lodging in the cerebral vessels is no longer generally accepted; on the other hand, the view that chorea is one of the manifestations of the rheumatic toxæmia of which endocarditis, pericarditis, arthritis, and subcutaneous nodules are other common examples, has gained very wide support and may be regarded as the most modern and reasonable solution of the question. If this theory is accepted it is no longer necessary that in every case of chorea a history of a preceding attack of arthritis should be forthcoming in order to justify the assumption that the chorea is rheumatic in origin, a position which finds an analogy in regard to attacks of endocarditis in children who have no obvious rheumatic history. However this may be, it is an undoubted fact that attacks of chorea are often excited by some emotional disturbance, by prolonged intellectual effort and by other less common causes the exact influence of which is not altogether clear. Speaking generally, bright, highly-strung, precocious children are more susceptible to this disease than those of a phlegmatic type.

Another clinical fact of interest in regard to the etiology of chorea is the liability to repeated attacks and the occurrence of these attacks at particular seasons of the year in almost epidemic form. Any one who has had charge of a large out-patient department at a children's hospital must have noticed how the numbers of choreic patients tend to swell at periodic intervals and how many old cases will return with fresh attacks at about the same time.

Chorea occasionally occurs in young pregnant women, usually in first pregnancies, and between the second and fifth months; in these cases it often assumes a severe form and gives rise to grave anxiety.

From the preceding brief references to the etiology and pathology of chorea, it is clear that the two chief causal indications for treatment must be derived on the one hand from the rheumatic and on the other from the emotional or intellectual associations of the disease.

Rest and **good feeding** are sufficient, it has been maintained,to cure the large majority of cases of chorea, and these are undoubtedly most important conditions of cure; but so long as the physician bears in mind the fact that even the slighter forms of this affection may develop into the graver and uncontrollable ones, he will be anxious to adopt whatever therapeutic measures are available to prevent so serious a possible development of the malady. The **indications,** then, for the **treatment** of cases of chorea may be thus stated :—

1. Rapidly to relieve, if possible, the slighter forms, so as to prevent their development into the graver forms, or their passing into a chronic state.

2. To relieve restlessness and sleeplessness, and so obviate fatal exhaustion in the more severe cases.

Of the vast array of drugs that have been proposed in the treatment of chorea there are many which may be dismissed very briefly. Apomorphia, lobelia, belladonna, cypripedium, cannabis indica, aniline, picrotoxine, amyl nitrite, and tartarised antimony may be at once rejected, as more likely to do harm than good.

To this list many more could be added on the ground that, although harmless, they have no definite effect upon the cause of the disease.

The important question arises:—Is there any drug which can in a majority of cases be relied upon to cut short the usual duration of an attack and to minimise the danger of the more serious symptoms developing? In answer to this question various authorities have given various replies, but from personal experience we have no hesitation in saying that **aspirin** has, alone of the many drugs we have tried, a most definite and, in the large majority of instances, certain beneficial influence. We have used it in a great number of cases over several years, and have rarely seen a patient, taken fairly early in the attack, fail to show rapid signs of improvement under its exhibition. Owing to the fact that choreic children have repeated attacks, sometimes every year for five or six years, their mothers are able to form unbiassed opinions upon the relative merits of the medicines with which their offspring are treated, and we have repeatedly received unsolicited corroboration of the results of our own observations from this source. Once their children have received aspirin they will consent to the use of no other remedial agent for subsequent attacks. With this drug, as with any other in the treatment of chorea, it is advisable to obtain as complete mental and physical rest for the patient as is possible and to insist upon the child being supplied with ample and nutritious food. Aspirin should be given in the form of powders or suspended in mucilage and water about half an hour after food. Children over six years of age may take 10 grains three and even four times in the twenty-four hours with safety, and after ten years of age 15 grains may be administered in the same way. Large doses of salicylates have also been strongly advocated for the treatment of chorea, but many authorities regard them as more depressing than aspirin in their influence upon the heart.

Of other medicinal agents *arsenic* has enjoyed the most prolonged and most widespread reputation. It probably acts as a tonic and improves the general nutrition, but its administration in large doses has too often led to the production of very intractable peripheral neuritis, as well as to other symptoms of intoxication, such as vomiting, blepharitis, diarrhœa, and dermatitis, to render such heroic measures justifiable.

It is usual to begin with a full dose of 5 minims of Fowler's solution thrice daily, and to increase the dose by 1 minim daily until it reaches 15 minims. This dose should be continued for about a week, and then again increased every three or four days until the physiological effects of the drug become manifest; the arsenic should then be discontinued for a few days. Tolerance is soon established, and the medicine may be again resumed in full doses. Seguin has given as much as 27 minims for a dose, which he prescribes diluted in a large quantity of water, and taken in divided drinks after meals. It may be given in water flavoured with a little syrup of orange or lemon peel. Sachs judiciously suggests that the night dose should be combined with a dose (15 or 20 grains) of potassium or sodium bromide. Some prefer to give arsenic by the hypodermic method, with the idea that they obtain more quickly the full remedial effect with much smaller doses: 1 to 4 or more minims of Fowler's solution, mixed with 15 minims of liquid vaseline, have been thus given. Some French physicians have also administered *cacodylate of sodium* hypodermically with the same object; beginning with $\frac{1}{3}$rd grain, the dose has been gradually increased to $\frac{2}{3}$rds daily. It has also been given successfully by rectal injections.

In all cases the physician should order *rest* for a certain time, wholly or partially in bed, according to the severity of the case, together with light but supporting food. At first the rest should be *absolute*, and no occupation, even by way of amusement, should be permitted. If practicable, it is best to confide the child to the care of a nurse, apart from the rest of the family. As the patient improves, a little exercise of the mildest kind may be allowed. In fine warm weather the patient may be swung in a hammock, or may recline on a couch, in the open air. Rest allays nervous and muscular irritability, and, if endocarditis exists, by quieting the action of the heart and reducing its labour it reduces the strain on the valve segments to a minimum. Educational tasks must not be thought of until long after the cure has been completed. Indeed, as a preventive, or to arrest the tendency to recurrence, all neurotic and sensitive children should be protected from educational strain and worry. The food should be nutritious but simple, and such as can be easily digested. While the patient is in bed an exclusively milk diet may be appropriate: and if milk is not well borne, koumiss has been found to answer well; but a mixed diet of eggs, fish, meat, and milk is often well tolerated. Tea, coffee, alcohol, and sweets must be avoided, and also too much farinaceous food.

While referring to the matter of food, we may add that in those severe cases in which feeding by the mouth is difficult nutrient enemata must be given. The cold wet pack has been found very soothing and sleep-procuring, and so has a daily warm bath of ten to fifteen minutes' duration, followed by the quick passage of a cold wet sponge down the spine; in somewhat chronic cases, in young chlorotic or hysterical girls, without any cardiac complication or rheumatic tendency, a tepid or cold douche to the spine every morning for 15 seconds will often be found to be followed by vast improvement. The water should at first be tepid, and the temperature gradually lowered. In summer the water can often be used at once of the natural temperature, and may be "dashed forcibly against the back of the neck and spine once or twice a day."

Gymnastics and *massage* have their uses also in the late treatment of chorea; the latter may be serviceable for stout anæmic patients whose muscular movements are not sufficiently under control to benefit by gymnastics, which are only suited to slight or chronic cases, with but little muscular inco-ordination. The gymnastic movements most suitable to the treatment of chorea are rhythmic ones with the accompaniment of singing.

We have had but little experience of the application of *electricity* to the cure of chorea; but Dr. Constantin Paul has applied the electric bath with advantage in certain cases, and Rockwell states that "when a case has continued without amelioration for several months" he regards "electricity in some form as far superior to any and all other methods of treatment." He uses both "general faradisation and central galvanisation; the ascending current is to be preferred in the treatment of chorea located in a single muscle or group of muscles, and general faradisation is far more efficacious when the disturbances are at all general. If the applications are skilfully made, they will act both as a tonic and as a sedative, to allay irritability and induce sleep." Jacoby,* however, is by no means impressed with the value of electrical treatment in these cases; he says: "My own experience has been such as to warrant me in saying that better results can be obtained in nearly all cases of chorea by some other means . . . . and that the only permissible mode of treatment is central galvanisation, or subaural galvanisation combined with anodal applications to the affected parts."

In addition to the drugs which have already been mentioned, we think it right to refer to others which have at one time or another been used in chorea without attaining an assured position.

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* Cohen's "System of Physiologic Therapeutics," vol. ii., p. 186.

Quinine in large doses has the authority of H. C. Wood in its favour, but, except in convalescence, as a tonic, we have not obtained any noteworthy results from its use.

Strychnine has the high authority of Trousseau to recommend it; and we believe its administration may be valuable in cases where symptoms of nervous exhaustion and cardiac debility, rather than those of nervous irritation, predominate: and as a cardiac and nervine tonic, after the choreic symptoms have to a great extent passed away, it may also be useful. But for the central excitement and irritability, upon which the more serious choreic phenomena depend, we do not regard it as a suitable remedy.

Zinc compounds formerly enjoyed a vogue—the sulphate, the oxide, the valerianate and the phosphide; the oxide or the sulphate in doses of 3 to 5 grains after a meal, three or four times a day, the dose being gradually increased to 8 or 10 grains. The phosphide is indicated only in cases of great nervous exhaustion; it may be given in doses of $\frac{1}{20}$th to $\frac{1}{10}$th grain three times a day in a pill with 1 or 2 grains of extract of hyoscyamus.

The valerianate and the bromo-valerianate in 1- to 3-grain doses, thrice daily, made into a pill with extract of henbane in the same way, we have found answer exceedingly well in cases where arsenic appeared to exercise but little beneficial effect.

The usefulness of sedatives and hypnotics in the severer cases cannot be doubted; and even in the slighter cases, if they are accompanied by insomnia and nocturnal restlessness, we hold it as an indication of the first importance to procure sleep. If we neglect this indication, we must be prepared to see the slighter cases often develop into the graver forms.

Both cimicifuga and conium are of use in the treatment of chorea; the former is more valued in America than in England.

Conium is especially valuable on account of its sedative properties, and is therefore applicable to cases accompanied by restlessness and insomnia; but its quieting action is brief and evanescent, and larger and still larger doses are needed to maintain its influence; the succus conii has been given in from 1- to 7-dram doses hourly. It is chiefly as a temporary expedient that it is of use, and Whitla states that in one case he considers it "kept the child alive until the arsenic had time to act."

Hyoscyamine, or hydrobromide of hyoscine, given hypodermically, in doses of $\frac{1}{100}$th to $\frac{1}{60}$th grain, has been found a most efficient remedy for arresting the exhausting movements in the severer cases. It has been pushed until its physiological effects (dryness of the mouth and dilatation of the pupils) are observed. The dose of $\frac{1}{100}$ grain several times daily will usually suffice. Bourneville and Katz have given bromide of camphor in 3-grain doses in capsules with rapidly good effect in some cases.

Hypnotics are also urgently indicated when there is sleeplessness. Rest to the nervous system must be obtained if we would avoid the risks of fatal exhaustion. In the milder cases a few doses of sodium or ammonium bromide (10 to 20 grains) combined with chloral (10 to 20 grains) given at bed-time and repeated during the night, if necessary, will often be attended with remarkable amelioration of the general symptoms, and natural sleep will follow without the need of further repetitions of this dose.

In more severe cases larger and more frequent doses may be necessary, and rectal injections of chloral have been found very useful—10 to 30 grains dissolved in 2 or 3 ounces of water thrown into the rectum every five or six hours, if necessary.

Bouchut gave 45 grains of chloral after the morning meal, so that the child might sleep till noon, and 45 grains more after its mid-day meal; the child usually woke up about six for his supper and fell asleep again afterwards. In this way he sometimes kept the choreic child asleep during several days.

The free administration of chloral has been found most serviceable in the *chorea of pregnancy;* keeping the patient in a continual sleep, waking her up only for meals, the food at the same time being limited to milk and eggs. In these cases arsenic must be used with caution. In severe cases it will sometimes be necessary to produce abortion or premature delivery.

Chloralamide has been found efficacious as a hypnotic in 10- to 30-grain doses, and so also has sulphonal; and *trional*, in 10-grain doses three times a day, or in a single dose of 20 grains at bed-time, has been very favourably reported on.*

It is rarely advisable to give morphine or opium until other drugs fail in procuring sleep. They should then be given with caution, and preferably by the mouth, as morphine administered hypodermically sometimes produces a very depressing effect on the heart.

In the gravest cases, when the movements are very violent and uncontrollable, and the patient can with difficulty be retained in bed, and the prominent parts of the body become bruised and excoriated, inhalation of chloroform may be needed; we should push the inhalation to complete narcotism, otherwise the patient will soon reawaken, and the amount of chloroform ultimately consumed will be greater. Dr. Churton has recorded a case † (a girl seventeen years of age) in which, after the failure of chloral in frequent doses of 20 grains to restrain the choreic movements, he succeeded in keeping them completely under control by giving morphine hypodermically, followed by the inhalation of chloroform for a few minutes. He began with $\frac{1}{6}$ grain of morphine, but had to increase the dose to $\frac{1}{2}$ grain before he obtained the desired result. Osler advises the "wet pack" in these cases as likely to prove very soothing.

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* *Brit. Med. Journal*, Feb. 1st, 1902, p. 267.

† *Brit. Med. Journal*, March 24th, 1894.

Hypnotics should be discontinued as soon as possible.

Lubleski, of Warsaw, applies ether spray along the spine for five minutes at a time, night and morning, by means of a Richardson's apparatus; he considers it often diminishes the intensity of the choreic movements.

A prolonged lukewarm bath at night has also been found very calming, and has relieved insomnia.

It is still necessary to add a few generalities. When the spasmodic movements are severe, steps must be taken to prevent the patient injuring his limbs or bruising the soft parts; he should, therefore, lie on a soft and broad mattress, well provided with pillows, and preferably on the floor—the knees, elbows, and other parts exposed to injury may be wrapped in cotton-wool. It may be needful to provide a water-bed as a protection against bed-sores, and the most scrupulous cleanliness with regard to the evacuations, etc., must be carried out. Alcohol, in moderation, should be given in severe cases when exhaustion is threatened. The bowels should be kept relieved by mild aperients. Anthelmintics should be given if there is any reason to suspect intestinal worms, and all possible sources of irritation should be sought out and removed, defective teeth, the constipated habit, errors of refraction, etc., etc. In anæmic cases, and in convalescence, tonics, such as quinine and strychnine, will be needed, but iron should never be given until all signs of chorea have disappeared, as it appears to favour rather than to counteract the disease itself. Cardiac tonics, such as digitalis and strophanthus, may also be required if the heart's action is feeble and when valvular disease exists. If cases tend to become chronic, notwithstanding treatment by rest and seclusion, change of air and scene should be prescribed. Guard carefully against recurrence, especially during the spring,* by protecting the rheumatic from chill, and the sensitive and neurotic from all over-exertion or strain, mental or physical, and look to the maintenance of the due nutrition of the body.

PARALYSIS AGITANS

Shaking Palsy—Parkinson's Disease

This is an easily recognised disease of the nervous system not associated with any constant lesion, but due probably to degenerative changes in the middle or higher centres of the brain. A very brief sketch of its clinical characters must suffice as an introduction to an account of the therapeutic measures which have been recommended, from time to time, by neurologists for the alleviation of the symptoms that attend it. All authorities appear to be agreed that the disease is not curable by any known methods of treatment.

The symptoms are very characteristic, viz. *muscular tremor, muscular weakness, and muscular rigidity.* Gowers speaks of it as "a true senile affection. . . A failure of nutrition of special character in special structures." Its *causation* is somewhat obscure. It is more common in men than in women, and it is rare to meet with it before middle age. A great variety of exciting causes have been put forward, the chief of which are prolonged mental emotion, severe mental shock, worry and anxiety; exposure to wet and cold; physical injuries; specific fevers; and as a contributing cause, the fact of belonging to a neurotic family.

Of the *symptoms* the *tremor* usually begins in one of the hands, and is associated with weakness and stiffness of the muscles. The tremor is usually, at all times, most marked in the hands. At first it is not constant, but appears after any exertion. Next to the hand it affects the ankle-joint. Commencing on one side of the body, it extends after a time to the other.

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* Weir-Mitchell recommends that arsenic should be given as the spring begins in cases where there is a fear lest "the habit of vernal recurrence of chorea" should be established ("Lectures on Diseases of the Nervous System").

There is also in advanced cases some vertical head-shaking (as in old age), aggravated by emotion and due to contraction of the muscles of the neck. The tremor will often cease for a time during *voluntary movements*, but after any considerable effort will return with increased intensity; indeed, great excitement of any kind increases the tremor. A *distinctive* feature is that the tremors continue while *at rest.* This distinguishes it from most other forms of tremor. They cease, however, during sleep, although they often hinder the patient from falling asleep. Passive movements arrest the tremor temporarily, and in some cases even for a long time.

Owing to the muscular weakness the movements are slow and deliberate, and the muscular *rigidity* imparts a stiffness as well as slowness to the voluntary actions. The *attitude* and *gait* are peculiar; the head and back are bent forward, the arms are somewhat abducted, and held in front of the body; the face is expressionless and mask-like; the patient walks with short, hurried steps (festination). It has been observed that the *rigidity* is relatively the most prominent feature; that it is this that retards and impairs active movements, and that this rigidity and the characteristic gait and expressionless face may precede the tremors.

The sensibility is unimpaired, but these patients are very apt to complain of heat, and more rarely of cold. Aching pains in the region of the neck and shoulders are often the source of much distress. The mental condition is unchanged except for a very natural feeling of depression.

The *course* of this disease is progressive, but usually the progress is very slow, and so far as life is concerned the prognosis is favourable; such patients generally die of some intercurrent affection.

From this brief sketch of the chief features of this disease we pass on to a consideration of its **treatment**, which it must be admitted is not satisfactory. Oppenheim says that "the physician may do much harm and little good," and Gowers observes that "of all the degenerative diseases of the nervous system this is the least amenable to therapeutic agents."

It is important to avoid all causes of excitement, mental calm being of great importance. Baths and health resorts are, therefore, better avoided, and a quiet country life (being much in the open air) should be preferred.

Electricity has been found by Gowers to have no influence. Oppenheim thinks massage and electricity of no benefit, but electric baths, especially the bi-polar faradic, have done good in certain cases, and Jacoby admits that "hydro-electric baths often bring about temporary relief of certain minor symptoms," but "only by their psychic effect."* Gowers considers massage gives only slight temporary relief, but "gentle upward rubbing of the fingers and hands" relieves the tremor, and Oppenheim has found that rubbing down with warm water or warm baths may do some good. Systematic exercises have seemed to be beneficial. We have found that the administration of thyroid extract in moderate doses has sometimes relieved the distressing sensations of which the sufferers complain, but it does not appear to affect the course of the disease.

Such tonics as quinine, arsenic, and strychnine are useful, but we must avoid "over-stimulation of too excitable tissues." Gowers prefers a combination of tonics and sedatives, as Indian hemp with arsenic and very small doses of strychnine.

Oppenheim found tincture of veratrum viride, 3 to 4 drops several times daily, lessen the tremor in several cases; he combines it with tincture of gelsemium. Erb gives large doses (♏vj to ♏xij) of

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* Cohen's "System of Physiologic Therapeutics," vol. ii., p. 187.

Fowler's solution with nux vomica. Both Erb and Oppenheim have given hyoscine and sulphate of duboisin, and found them useful for quieting the tremor; but these drugs, being powerful poisons, have to be used with great care to avoid their toxic effects. The dose of either is about $\frac{1}{200}$ grain to commence with.

To relieve sleeplessness it may be necessary to give bromides or chloralamide or sulphonal. It is usually desirable to avoid giving morphine.

Charcot noticed that some of these patients were better when travelling by rail or in carriages, and on this account vibratory chairs and other mechanical means of treatment were introduced, but Oppenheim* has found them of little benefit.

A simple but nourishing diet should be prescribed and all strong stimulants avoided, such as alcohol or strong tea and coffee. The patient's apartment should be well ventilated. Being much in the open air in a fairly bracing climate has been found advantageous. Carriage exercise, as has been pointed out, allays the tremor.

In advanced cases, owing to the muscular weakness and unsteadiness, the patient should not be allowed to walk about by himself, for fear of accidents.

ADDITIONAL FORMULÆ

Oxide of zinc in chorea

℞ Zinci oxidi, gr. iij ad gr. vj.
Sacchari albi, gr. lxxv.

M. et div. in pulv. vj. A powder three times a day. (*Bamberger.*)

Hypodermic injection of arsenic

℞ Sodii arsenatis, gr. jss.
Acidi carbolici, ♏iij.
Aquæ destillatæ, ʒijss.

M. f. solutio. Initial dose for hypodermic injection = five minims. (*Widerhofer.*)

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* "Diseases of the Nervous System" (Mayer's translation), p. 839.

Arsenical mixture for chorea

℞ Liquoris Fowleri, ♏xxx ad ♏xlv.
Syrupi simplicis, ℥j.
Aquæ ad ℥viij.

M. f. mist. A tablespoonful three times a day. Also application of constant current along spine. (*Benedikt.*)

Another

℞ Liquoris arsenicalis ♏lxxx.
Syrupi zingiberis, ℥j
Aquæ cinnamomi ad ℥iv.

M. f. mist. Two teaspoonfuls, gradually increased to four or more, three times a day after meals. (*J. B. Y.*)

Pills for chorea

℞ Asafœtidæ, gr. xx.
Extracti valerianæ, gr. xx.
Zinci oxidi, gr. x.
Castori pulv., gr. xx.
Extracti belladonnæ, gr. ij.

M. et div. in pil. xx. One or two night and morning. (*Dujardin-Beaumetz.*)

Bromide of potassium pills for chorea

℞ Potassii bromidi, gr. lxxv.
Pulveris et extracti glycyrrhizæ, q.s.

Ut f. pil. xx. Five pills twice a day. (*Bamberger.*)

Also

℞ Chloral hydratis, gr. lxxv.
Syrupi aurantii, ℥jss.
Aquæ ad ℥ivss.

M. f. mist. A tablespoonful every hour until a sedative effect is produced. (*Bamberger.*)

Iron and arsenic mixture after chorea

℞ Tincturæ ferri perchloridi, ʒij.
Liquoris arsenicalis, ʒiij.
Glycerini, ℥j.
Aquæ chloroformi ad ℥v.

M. f. mist. A measured teaspoonful in water after food three times a day. (*Whitla.*)

Quinine, iron, and arsenic, after chorea

℞ Ferri redacti, gr. j ad iij.
Quininæ sulphatis, gr. ij ad v.
Acidi arseniosi, gr. $\frac{1}{50}$ ad $\frac{1}{30}$.

In a pill or capsule, thrice daily. (*Sachs.*)

Tonic powders after chorea

℞ Quininæ sulphatis, gr. $\frac{3}{4}$.
Ferri carbonatis saccharati, gr. $\frac{3}{4}$.
Sacchari albi pulveris, gr. v.

M. f. pulv. To be taken twice a day. (*Widerhofer.*)

CHAPTER VI

TREATMENT OF EPILEPSY

The Different Forms of the Attack—Etiology—Warnings—Aura—*Petit Mal*—*Treatment:* (1) During the Paroxysm; (2) of the Pre-paroxysmal Stage; (3) in the Intervals—Preventive Measures in Predisposed Children, and Hygienic Treatment—Treatment in Colonies—Alkaline Bromides—Mode of Administering them—Bromism—"Salt Starvation"—Other Bromides—Flechsig's Method—Borax—Belladonna—Digitalis and other Cardiac Tonics—The Bechterew Treatment—Zinc Compounds—Cannabis Indica—Chloral—Nitrites—Antipyrin—Fleury's Treatment for Auto-intoxication—Treatment of *Syphilitic*, *Strumous*, and *Anæmic* Cases—*Management of Complications*—Coma—The *Status Epilepticus*—Surgical Treatment. Additional Formulæ.

By **epilepsy** is meant a disease of the nervous system, characterised by attacks of unconsciousness, with or without convulsions. These attacks, or "fits," as they are termed, are apt to *recur*, in a paroxysmal manner, at irregular intervals. When they take the form of a very brief loss of consciousness, without convulsions, the disease is known as the *petit mal;* when, on the contrary the loss of consciousness is attended with general convulsions, the disease is spoken of as the *grand mal*. *Epileptiform* convulsions—that is to say, convulsive attacks having a general resemblance to epilepsy, may occur as symptomatic of various forms of disease of the nervous system—as, for example, of syphilitic disease—but these are not regarded as instances of "idiopathic" or true epilepsy. Localised convulsions, without loss of consciousness, generally connected with definite cerebral lesions, may also occur, and they are known as cases of Jacksonian epilepsy.

As to the **causes** of epilepsy: childhood and youth are certainly predisposing ones. It begins frequently during childhood, and also about the age of puberty, and but rarely after 25 to 30; 50 per cent. of the cases are said to commence in the second decade.* It is generally considered that epileptiform convulsions, occurring in the adult, should be regarded as very possibly due to syphilis or some other *local* lesion. It must always be kept in view that epileptic convulsions may depend on the existence of organic cerebral disease.

The influence of heredity as a predisposing cause of this disease is somewhat variously estimated by different authorities, but even those who regard hereditary influence as playing but a small part in the *direct* transmission of epilepsy, admit that the children of *neurotic* parents, those prone to suffer from migraine, neuralgia, hysteria, and insanity, are especially liable to become epileptics. Oppenheim maintains that hereditary influence can be traced in one-third of the cases, Gowers says in a half. *Alcoholic habits* and chronic lead-poisoning in the parents seem to convey a decided predisposition to epilepsy in their children.

Whether *syphilitic* parents can convey to their children a tendency to epilepsy, in its idiopathic form, is doubtful; but *symptomatic* epileptiform convulsions are frequently dependent on actual syphilis of the nervous system, which may be either transmitted or acquired.

The frequent occurrence of this disease in children in connection with attacks of the specific fevers seems to point to some peculiar effect of toxins on the nervous system in starting the epileptic habit.

Emotional shock, such as fright or anger, appears to be capable of inducing attacks of epilepsy; masturbation and sexual and alcoholic excitement are also recognised causes. Epileptic seizures after injury (traumatic cases), such as a blow on the head, especially in the neurotic and alcoholic, are not uncommon; much more rarely they arise after an injury to peripheral nerves, or irritations from scar tissue, or from the pressure of a foreign body.

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* Oppenheim, *op. cit.*

Dentition, diseases of the nose, laryngeal polypi, menstruation, intestinal worms, dyspepsia, gall-stones, small surgical operations, have all been mentioned as exciting causes of epileptic convulsions. The removal of carious teeth, of foreign bodies in the ear, and the correction of errors of refraction, in persons afflicted with epileptic attacks, have been observed to be followed by a cessation of the fits, at any rate for a time.

It has been suggested by Voisin, Bouchard, Haig and others that the epileptic attack may be due to auto-intoxication—the retention of toxic material in the blood ; and this view is supported by reference to the fact that the urine after an attack is richer in toxic products than that passed before the attack. Uric acid by some, ammonium carbonate by others, have been suggested as the toxic agents. Further observations in this direction will doubtless be made; at present the theory is by no means widely accepted.

It is unnecessary here to describe, in detail, the familiar phenomena of an epileptic seizure, but a few words will not be out of place on the occurrence of the so-called *aura* premonitory of the approaching attack, on some *post*-epileptic symptoms, and on the character of the attacks of *petit mal.* The epileptic **aura** is a localised sensation of a somewhat vague character occurring sometimes in the hand, or in a finger or toe, or in the epigastric or cardiac regions, and in the latter attended with heartburn or palpitation ; or it may be referred to a tender spot on some other part of the surface of the body. Disturbed conditions of the special senses may produce visual (flashes of light), auditory (noises and sounds), olfactory (unpleasant odours), and gustatory (disagreeable tastes) auræ. A strange dreamy state, or one of fear and dread, may also precede the attack. Or certain motor auræ may be observed, such as rotatory or running movements.

These epileptic auræ may last from a few seconds to several minutes, or even longer, and it sometimes happens that the patient learns to ward off the threatening fit before the aura is completed.

A loud scream or yell usually indicates the onset of the epileptic convulsions and state of unconsciousness.

After the attack has passed away the epileptic is sometimes left in a curious trance-like condition, in which he is not responsible for his actions; he retains no recollection of them, and in this state homicidal tendencies (mania) are occasionally developed. Sometimes transient hemiplegia and defects of speech may follow an attack, and sometimes much mental feebleness may be the result. It is important to remember that epileptic attacks may occur at night without the patient being aware of them.

Attacks of **petit mal** frequently assume such a variety of forms that their nature is, no doubt, often misunderstood and unrecognised. The attack may be of such brief duration, the patient continuing to perform automatic actions, that it may pass unnoticed by the bystanders, or the patient may stagger and catch at something for support, or he may feel giddy and sit or lie down, or he may interrupt whatever he is engaged in for a minute or two, and then go on again as though nothing had happened.

A vacant stare, with slightly dilated pupils, and some pallor of the face, are often the only noticeable signs of such an attack. We should remember that what are termed "fainting fits" in children are often of this nature. Occasionally slight convulsive twitchings of certain muscles of the face and neck accompany these minor attacks.

The pathology of epilepsy still remains obscure, and the *principles of treatment* of this affection must be based rather on observation of the phenomena of the attack, and on the results of experience, than on the theories of pathologists.

The **treatment** of the epileptic may be regarded from three points of view: (1) the treatment during the paroxysm; (2) the treatment when the paroxysm is imminent—what may be termed the pre-paroxysmal stage; and (3) the treatment in the intervals.

It is scarcely needful to say that the history and circumstances of each case must be thoroughly investigated, so as not to overlook the presence of any exciting cause the removal of which might help towards a cure; such as intestinal worms, the irritation of undigested food, constipation, carious teeth, foreign bodies or polypi in ears, etc., cicatrices involving peripheral nerves, alcoholism, plumbism, syphilis, etc.

1. The treatment during the paroxysm is simple. The patient should be placed reclining on some soft, flat surface, where he cannot do himself injury during the violent convulsions. As the tongue is apt to be badly bitten by getting between the firmly-closed teeth, it is advisable to place between the teeth a bit of stout indiarubber tubing, or a wedge-shaped piece of strong cork, or something which will not be hard enough to injure the teeth, while it is tough enough to resist being bitten in two and swallowed. The head should be slightly raised, and all tightly-fitting clothes loosened.

Inhalations of nitrite of amyl (5-minim capsules) have been credited with the power of lessening the convulsive movements, and there can certainly be no objection to trying its effect, especially when the convulsive movements are violent or prolonged. Inhalations of chloroform and hypodermic injections of morphine ($\frac{1}{4}$ grain) have been used for the same purpose. The sleep which usually follows an attack should not be disturbed. In the case of nocturnal attacks, provision should be made to prevent, if possible, the patient turning over on his face at the end of an attack, which brings with it the risk of death from asphyxia.

2. The treatment of the pre-paroxysmal stage may next be considered. In cases where the attack is preceded by a well-marked aura, it is no doubt possible in some instances, by the adoption of suitable

measures, to prevent the attack. An old and familiar expedient is to tie a string round the limb in which the aura is felt, between its place of origin and the rest of the body. The application of a blister has been said to have the same effect. Cases are also on record in which the seizure has been prevented by cauterisation of the spot from which the aura proceeds, or by the application of laudanum to a tender surface aura (*Wilks*), or by extension of the leg muscles when the fit was preceded by jerking and flexion of the limb (*Reynolds*), or by forcible extension of the fingers when the attack followed spasmodic closure of the hand (*Bazire*). Such expedients are, however, of very uncertain efficacy. Dr. J. C. Da Costa states that in the Philadelphia Hospital it was found that a sudden electric shock was especially apt to be successful, and "almost as successful whether applied between the seat of sensation and the nerve centres or at some distant portions of the body." Both Weir-Mitchell and Crichton Browne testify to the utility of inhalations of nitrite of amyl in abating an epileptic fit, if administered as soon as the deadly pallor of the face appears, or when first the warning aura is felt. Gowers observes that "if it produces flushing of the face before the patient loses consciousness, the attack is usually cut short," and he thinks it especially useful in those cases with an olfactory aura.* Intelligent patients should be advised to carry capsules of nitrite of amyl about with them, so as to inhale deeply the contents of one as soon as the usual warning is experienced. Nitroglycerine given hypodermically has been found to have the same effect. In the majority of cases, however, an aura is either wanting or of such short duration that it allows of none of these measures being carried out.

3. We must now pass on to the chief consideration in connection with the treatment of epilepsy—viz. the *treatment* in the intervals between the

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* "Epilepsy" (2nd edition), p. 298.

paroxysms; and with this we may include the preventive treatment of the disease in the predisposed.

It is held by some physicians that attacks of infantile convulsions afford an early indication of an epileptic predisposition. This is certainly not always the case, but it is possible that it may be so in children of neurotic parents. After such attacks it is a wise procedure to put these children on a mild course of bromides for three or four weeks, in order to allay the convulsive tendency. Any source of peripheral irritation must, of course, be sought out, and, if possible, removed, such as worms, phimosis, dentition, gastro-intestinal irritation, etc. As they grow up, such children require firm, but gentle, control and discipline. Out-of-door exercise and occupation should be enjoined, so that when bed-time comes the child should feel a wholesome desire for rest and sleep. Violent emotional disturbances should be specially guarded against by early training to obedience and self-restraint, and all competitive tasks should be forbidden.

All stimulating and exciting foods and drinks should be prohibited, such as coffee, tea, and alcoholic beverages. The diet should be plain and simple, containing only a small amount of animal food, but composed chiefly of farinaceous foods and milk.

An ample proportion of sleep, in a well-ventilated bed-chamber, is an excellent tonic to a feeble, nervous system; wakefulness should be especially guarded against in the neurotic child as both exhausting and exciting; sometimes a little simple food, such as a glass of milk, or a cup of bread-and-milk, at bed-time, or during the night, will enable a wakeful child to sleep. It must be remembered that digestion in quickly-developing children is often very rapid, and the need of food at short intervals is apt to be lost sight of, and a child may be wakeful on account of hunger.

The acquirement of evil sexual habits must be especially guarded against. It is advisable, if restful sleep at night cannot otherwise be secured, to give a small dose of bromide at bed-time.

The occurrence of constipation must also be prevented; and it must be insisted upon that a daily solicitation of the bowels, at a regular fixed hour, should be the invariable practice—a practice very commonly neglected by young growing girls. Instead of laxative medicines (of which a dose of Gregory's powder, or of the compound liquorice powder, is best), the regular introduction into the diet of some aperient vegetable or fruit is advisable; boiled spinach, onions, watercresses, lettuce, oranges, bananas, and stewed figs and prunes are all suitable. Anæmia, or signs of nerve-exhaustion, indicate the need of tonics, with lime salts, such as the compound syrup of the hypophosphites, or some mixture containing arsenic. It is best to avoid the use of iron with those who are predisposed to, or suffering from, epilepsy.

Mental tasks must be imposed with great moderation, and all competitions, as we have said, avoided, and exciting, emotional literature forbidden.

By the careful study and application of the foregoing suggestions we may hope, in many instances, to prevent the neurotic child from becoming an epileptic youth.

The main object of **treatment** in the **intervals** between the paroxysms is to prevent the occurrence, or diminish the frequency, of the convulsive seizure, knowing, as we do, that every attack increases the liability to another, and that the more ingrained the habit becomes, the more difficult is the disease to cure.

We have anticipated much that need be said on the matter of the *hygienic* treatment of the epileptic, in what has immediately preceded. The same rules of life which we have laid down as applicable to neurotic children with a proneness to epilepsy, will apply with equal force to those who have actually become epileptic.

With regard to food, there is a considerable weight of evidence in favour of restricting the epileptic to a vegetarian diet and milk. A marked diminution in the frequency and the severity of the seizures has been observed in many cases to follow the limitation to purely vegetable food. After a time, if the patient wishes it, fish and eggs in small quantities may be permitted. The food, of whatever kind, should be always moderate in quantity, well prepared, and easy of digestion. All stimulating beverages and tobacco are best avoided. Food just before bed-time should be forbidden. The sexual passion should be kept under severe control; and in this matter the usual medicinal treatment by bromides greatly helps us, by lessening the sexual appetite.

Marriage is, of course, out of the question.

Occupation should, if possible, be found for the epileptic, but it should be free from all excitement and strain. It is a great mistake for medical men to order all epileptic children to cease attending school or learning lessons. Provided that the education is not over-done, the discipline and concentration of attention associated with classes are of immense service to these patients.

Regular daily exercise should be insisted on, and a regular action of the bowels seen to.

In Germany and in the United States *colonies* have been founded on an extensive scale for the education and treatment of epileptics, and one on a smaller scale exists near London, at Chalfont in Buckinghamshire. In these colonies the patients are submitted to such restrictions that control of their acts is at all times secured. Those who arrive in feeble health are treated on hygienic principles directed to the restoration of their physical vigour. For this purpose various means are employed: medicines, systematic occupation, gymnastic exercises, baths, a special diet, and the application of such *moral* influences as may be needed. The occurrence of auræ is looked for and studied, and investigations are undertaken with the view of detecting the presence of any toxic substances in the blood, urine, or other secretions that may bear any causal relation to the attacks.

The nature and amount of the patients' food are strictly regulated. Alcoholic stimulants are prohibited. Tea, coffee, and tobacco are permitted (in American colonies) in moderation. A patient whose habits have been sedentary is gradually induced to live in the fields, exposed to the sun and air. An attempt is made to throw his life into new channels. All mental efforts and strain are avoided and physical exercises are freely enjoined. But, if the physical development preponderate, efforts are made to develop co-equally the weak intellect. Recognition and encouragement are given to any wholesome natural bent or inclination in the way of mental or physical work. These regulations, as applied in the Craig Colony, U.S.A., have led to the cure of 6 to 8 per cent. of all cases treated there.

No *medicinal* treatment of epilepsy that has, as yet, been discovered at all equals in efficacy the alkaline **bromides.** Their beneficial effects are attributed to their influence on the cerebral cortex, diminishing greatly the excitability of the cells of the motor areas.

In a few cases the administration of the bromides leads to permanent cure; but in the majority it simply inhibits the attacks, and on the cessation of the treatment the convulsions are apt to recur. They have been found of less value in the *petit mal* than in the *grand mal*, and in nocturnal than in diurnal attacks. The bromides, in some cases, after a time, lose their protective power; and in a small number of instances they fail to be of use at any time. A certain method should be adopted in the administration of the bromides, and especially in the adaptation of the dose to particular cases, and in the selection of the most suitable combination.

Originally the potassium bromide was the salt invariably prescribed, but of late years there has been a tendency to endeavour to replace this salt by other bromides, and especially by the sodium and ammonium bromides. The sodium bromide is, no doubt, less irritating, and much less depressing to the circulatory and muscular systems, than the potassium compound; and it is better tolerated during long periods of use; but some physicians maintain that it exerts less control over the epileptic paroxysms than the potassium salt. The ammonium bromide, if given alone in large doses, has been found excessively irritating to the stomach. In short, most authorities are agreed that the best results are obtained from the **mixed bromides.** Some use the potassium, sodium, and ammonium bromides in equal parts; and others prefer two parts each of the potassium and sodium salts to one part of the ammonium salt. It is best to give the larger doses, which we are sometimes obliged to administer, *well diluted* with milk, which almost completely disguises the taste, or with milk and some alkaline mineral water, such as Vichy, Vals, or Apollinaris.

With regard to the appropriate dose, we must study each case and note the individual susceptibility to the medicine, and regulate the dose accordingly; some individuals will require much larger doses than others. We should remember that children are generally very tolerant of the bromides, and will often bear nearly as large doses as adults. Females usually require less than males.

It is best to commence with small doses—15 to 30 grains thrice daily for adults—and gradually augment the dose until we ascertain the amount needed to suppress the attacks. Gowers maintains that if 30 grains three times a day "do not produce arrest, larger doses are seldom successful." Some give rapidly increasing doses until anæsthesia of the palate and pharynx is induced (this may be ascertained by touching the parts with a feather), which takes usually about three weeks, and then the dose is decreased. Some French authorities consider the dose should be pushed, till the attacks disappear, even up to 5 or 6 drams a day. Very much depends on the *purity* of the bromide, and when any disappointment occurs in the result expected, this point should be looked to. If the fits are known to occur, with regularity, at some particular part of the day, or at other stated intervals, we should give a single large dose three or four hours before the usual time of the attack and smaller doses in the intervals. In nocturnal epilepsy we should give 50 or 60 grains an hour or two before bed-time. If the attack is prone to occur after getting up in the morning, we should give 30 or 40 grains at bed-time and repeat this dose on first waking in the morning. When the bromides are being taken regularly twice or thrice daily, it is best to give them about an hour after food, in order to avoid their occasional irritative effect on the gastric mucous membrane, and for the advantage of combining with them a small dose of arsenic to prevent acne; but when we are giving a single dose, with the view of producing an immediate and decided effect, it is best to give it when the stomach is empty, so that it may be quickly absorbed unmixed with food.

In the administration of the bromides in epilepsy, whilst it is necessary not to stop short of giving the quantity needed to produce the effect desired, it is also important to be on our guard against what has been justly termed its "ignorant and excessive use." It is well known that when saturation of the system has been reached, if the doses are not diminished, the most unpleasant symptoms of **bromism** appear.

The following are the symptoms which may be observed when this state of bromism has been induced: The complexion is dark and muddy, the skin cold and clammy and covered with acne, there is complete anæsthesia of palate and pharynx, the action of the heart is feeble and hurried, there are great impairment of memory, dilated pupils, hesitating speech, mental confusion and torpor, loss of sexual power, great drowsiness, unsteadiness of gait ; and, together with these symptoms, bronchial and gastric catarrh with fœtor of the breath may appear. On the other hand, it is a common mistake to attribute to the action of bromides symptoms, such as loss of memory, loss of moral tone, etc., which are really part of the epileptic syndrome. It is very unwise to cut off the bromides unless there is very clear evidence that toxic results are being produced. Gowers points out that the cerebral depression may be diminished by adding nux vomica or strychnine to the bromides with a little hydrobromic acid, and that 2 or 3 grains of caffeine to each dose will relieve the drowsiness. We must not, however, regard the appearance of acne alone as a sign of saturation ; this disquieting and disfiguring eruption will often occur after quite moderate doses in certain individuals ; it is best avoided by giving the drug largely diluted with some alkaline water, and by combining it with full doses of Fowler's solution from time to time.

Richet and Toulouse have suggested and carried out a method which they assert enables them to diminish greatly the dosage of the bromides without lessening their curative effects. It is the method of "salt starvation." By depriving the nervous system of the usual amount of salt in the food, the nervous tissue is rendered more susceptible to the absorption of medicinal salts, which it takes up to a remarkable extent, and so renders a small dose effective. They have thus been able, with a daily dose of 30 grains of sodium bromide, given under the conditions mentioned, to arrest epileptic attacks, sometimes in less than a week, no matter how frequent they had been before, and several patients showed no recurrence for six months. Corroboration of these observations has not been generally provided.

The next question for consideration is, how long is it desirable that the use of bromides should be continued after the convulsive attacks have ceased to recur? Certainly for two or three years, the dose being reduced gradually during the third year. This is the plan followed by the most experienced authorities.

Cases in which we must not expect much good to result from the bromide treatment are those dependent on inherited tuberculosis, those dependent on injuries or deformities of the skull, those caused by dentition, those due to syphilis (and requiring specific treatment); while cases difficult to influence favourably are those excited by menstruation, those accompanying mental disturbances, and those which are traceable to alcoholism in the parents. Masturbation provokes a return of the seizures, and interferes greatly with the good effect of the bromides. It is a good plan, as suggested by Osler, for the nurse or attendant, or a near relative of the patient, to keep a book in which the number and period of the attacks are recorded, as well as the quantities of the bromides given.

There is no doubt that the judicious administration of bromides, with or without other drugs to which reference will shortly be made, offers the only prospect of an alleviation or cure in cases of epilepsy, and that the efficacy of this line of treatment varies directly, if not constantly, with the earliness with which it is instituted, the regularity and conscientiousness with which it is carried out, and the favourable character of the surroundings of the patient.

Many other bromides have been used in the treatment of epilepsy besides those alkaline bromides we have been considering.

Lithium bromide has been found very useful in obstinate cases; it is given in doses of 5 to 15 grains.

Strontium bromide has been commended by Dr. Constantin Paul, who has seen it succeed after potassium bromide has failed. It is said also to be better tolerated than the latter: the dose is 10 to 30 grains. Gowers states that he has not found it superior to other bromides.

Nickel bromide and *rubidium and ammonium* bromide have been advocated, but Gowers points out that they can only be given in small doses, which are without influence.

Bromide of *zinc* depends on the metal for its activity, not on the bromide it contains. It can only be given in small doses, as in large ones it proves emetic.

Monobromate of camphor has been given in doses of 5 grains three times a day, and slowly increased to 10, 15, and even 20 grains. It is best administered in *perles* of 2 grains each. It has been found of use in cases attended with much sexual excitement; otherwise it seems of little value in epilepsy.

Ethylene bromide has been highly spoken of by Oppenheim.* He gives it in oily emulsion containing 5 per cent. of the drug flavoured with a drop or two of oil of peppermint. Adults take 30 minims in half a glass of sweetened water three times a day, increasing the dose every third day by 10 drops until a teaspoonful is being taken. Children between eight and ten years begin with 10 to 20 minims. It appears to be chiefly of use in cases of long standing. Further observations with this drug are needed. The value of hydrobromic acid in epilepsy has, we consider, been greatly overrated; its chief use is to acidulate bromide mixtures to which strychnine is added, in order to keep the latter in solution.

Bromipin or *brominol* is a combination of bromine and sesame oil. It is made of two strengths—one contains 10 per cent. and the other 33 per cent. of bromine. A dram of the latter corresponds to half a dram of potassium bromide. It is said to be very effective and to cause no rash and no depression, as alkaline bromides do. It can also be given by inunction into the skin, and by rectal injection. Given by the mouth it is not absorbed until it reaches the small intestine, where it is acted on by the bile and pancreatic juice. It can be given in capsules. It is a preparation that merits further trial.

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* "Diseases of the Nervous System," p. 782.

What is termed the *Flechsig* method consists in *first giving opium*—$\frac{3}{4}$ grain of the powder three times a day, gradually increased up to 15 grains or more daily. The opium is given for about six weeks and then completely suppressed, and bromides in large doses—2 drams daily—immediately administered. These doses are gradually diminished to 30 grains a day. The author of this treatment maintains that he has by it cured cases of epilepsy that have resisted all other kinds of medication, but Gowers remarks that the verdict of those who have tried the method is almost uniformly unfavourable.*

Although the bromides undoubtedly exercise a greater curative and palliative influence over this disease than any other drugs, yet it not unfrequently happens that their use fails to be attended with the benefit expected, or they disagree with the patient to such an extent as to preclude their continued employment; in these circumstances we must consider what other medicinal agents we may advantageously use in their stead.

Borax has been put forward as a valuable remedy in the treatment of epilepsy, and Gowers † considers it beneficial in inveterate cases in which the bromides prove of no effect. In some cases it seems of little use, whilst in others its influence is most decided, and a trial of the remedy would appear to be indicated in those individuals who cannot tolerate the bromides, and in those instances in which the bromides fail to produce any remedial effect. It is given in 10-grain doses at first, increased up to 80 or 90 grains daily, mixed with a little glycerine, syrup, and water. Smaller doses may be used combined with bromides. It should not be given in large doses at first, as it will sometimes cause diarrhœa with dysenteric stools. It occasionally, after long use, causes an eruption of psoriasis, which, however, usually disappears quickly on adding arsenic to the borax. Prof. Joseph Collins states, "after considerable experience with the use of borax in epilepsy," that its effect upon the disease is not "at all comparable to the bromides," but that for some cases in which the latter cannot be administered it is the best substitute.[*]

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* "Epilepsy" (2nd edition), p. 295.

† *Ibid.*, p. 286.

Belladonna, warmly advocated, before the day of bromides, by Trousseau in the treatment of epilepsy, has always been thought worthy of trial. He used to give it in small doses at first, $\frac{1}{5}$ grain of the powder and of the extract, in a pill, night and morning, for the first month, and every month an additional pill was added until the dose reached twenty pills twice a day. Oppenheim[†] uses the alkaloid *atropine*, and states that he has had good results from its use in cases in which bromides have failed. He begins with small doses, $\frac{1}{3}$ to $\frac{1}{2}$ milligram ($\frac{1}{200}$ to $\frac{1}{125}$ grain) several times a day in adults, and smaller doses in children. He has been able to use it continuously for years, though with frequent interruptions.

Gowers[‡] considers the utility of belladonna as an adjunct to bromides "unquestionable" in increasing their effect. He has found the addition of 5 minims of tincture of belladonna to 15 or 20 grains of bromide greatly diminish the frequency of attacks, which the bromide alone had failed to do. We have found this drug of special use in some cases of obstinate *petit mal.*

The cardiac tonics, *digitalis*, *strophanthus*, and *adonis vernalis*, have been found useful as adjuncts to the bromides in the treatment of many cases of epilepsy. They are useful in maintaining cardiac tone, which the bromides tend to depress, and their employment is especially indicated in cases complicated by cardiac disease, organic or functional. Gowers testifies that

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[*] Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 781.

[†] "Diseases of the Nervous System," p. 782.

[‡] "Epilepsy" (2nd edition), p. 281.

"attacks which continued on bromide alone ceased entirely on bromide and digitalis."

What is known as the *Bechterew* treatment consists in the administration of *adonis vernalis* combined with potassium bromide and codein. It is claimed for this method that the attacks are greatly reduced in frequency and in some cases completely suspended, while no bad results are observed. Digestion, circulation, and temperature remain normal and the mental condition unchanged.

Zinc compounds, and especially the *oxide*, have been found of value in epilepsy. Reynolds and Wilks testify to this effect. The oxide is given in 5-grain doses thrice daily. The citrate and the lactate are, however, preferred by many as less likely to cause stomach derangement; the dose of the former is 3 to 12, and of the latter 5 to 30 grains twice or thrice daily. Gowers considers that zinc has been too much neglected of late years, that it commonly lessens the frequency of the attacks, and that it is of distinct service in the few cases in which the bromides fail, and especially in cases of slight or moderate severity, very seldom in severe cases. He prefers the oxide in pills (3 grains) after food, the dose to be increased when it agrees well. He found occasionally that combined with bromide it increased its influence over attacks.

Cannabis indica has its advocates, and is said to resemble the bromides in its action. It may be given in ½-grain doses of the extract, or 10- to 20-minim doses of the tincture, but it is not a reliable remedy.

Chloral is an auxiliary remedy in the management of certain troublesome cases of epilepsy with a tendency to insomnia, violent convulsions, or maniacal excitement. It is of value by exercising a calming effect on the disturbed motor cerebral centres, and on the motor tracts in the cord, and by inducing sleep it allays mental excitement. It is best to reserve its employment till the evening, and not give it during the day, and it acts best when combined with bromides. Gowers says he has not found it useful in *ordinary* cases of epilepsy—but it is *not* in the ordinary cases that its use has been advocated In cases of cardiac debility it must, of course, be used with great caution.

Nitro-glycerine and the *nitrites* (sodium nitrite, nitrite of amyl, etc.) have been of late years largely used in the treatment of epilepsy. They are all worthy of trial, especially in cases of *petit mal*, but their effects are too evanescent to enable them to be of much use in the graver forms. One drop of the 1 per cent. solution of nitro-glycerine or a grain of sodium nitrite may be given three times a day. Gowers has found it of "singular service" in some cases, and a "useful adjunct to bromides in cases with feeble circulation, coldness, and pallor of fingers, and small, slow pulse." Also in minor attacks in young children between 3 and 12 years of age. He has given it combined with strychnine in those cases with advantage. In the periodical headaches of epileptics he has found it beneficial combined with hydrobromic acid, 10 to 15 minims. Prof. Joseph Collins * has also found it "particularly beneficial" in cases in which an aura precedes the attack.

Antipyrin given combined with ammonium bromide seems to be occasionally helpful in the practical management of epileptic cases. Prof. H. C. Wood's recommendation of this combination (antipyrin 6 grains, ammonium bromide 20 grains) has been corroborated by many other competent observers. Its use was unattended by bromism or any unpleasant symptom. It seems to have had the power of alleviating some quite hopeless cases.

Many other drugs (including *suprarenal extract*) have been put forward as of use in the treatment of epilepsy, but we have not thought it desirable to add further to the already long list of uncertain remedies. *Fleury*,† who believes in the theory of *auto-intoxication* as the cause of epileptic convulsions, looks for a remedy to a suitable diet and to means for preventing the development of intestinal toxines. After this has been accomplished bromides become more efficacious. Meat is only partaken of once a day, the evening meal being vegetarian. Hot water is the only beverage permitted. To cleanse the intestinal canal aperients are freely given, and copious enemata daily. If the stomach is dilated it should be washed out. Massage, cold douching, brine-baths, and mountain air he considers are all more or less important. He also thinks the hypodermic injection of an artificial serum —consisting of 1 per cent. of sodium chloride, sodium sulphate, sodium phosphate, and carbonic acid—useful, 8 to 10 grammes daily.

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. i., p. 781.

† *Journal de Médecine*, May 10th, 1900.

When the epileptic attacks are associated with any obvious constitutional vice or defect of nutrition, medicines directed to the relief of the latter, in combination with those more immediately directed to the prevention of the seizures, are clearly indicated. When there is any suspicion of syphilis, large doses of potassium iodide, 10 grains three times a day, gradually increased, must be combined with a mild bromide treatment, and mercurial inunctions if necessary. With feeble, ill-nourished cases, cod-liver oil is frequently very beneficial, but iron, as we have already said, should be particularly avoided. Strychnine has been found useful by Bartholow in anæmic subjects with signs of much nervous exhaustion and debility ; its use, however, is chiefly appropriate in cases of *petit mal.*

A seton introduced into the nape of the neck, blisters, and the actual cautery applied in the same situation, and the application of croton oil to the scalp, are rather expedients of the past than of the present. Electricity, in various forms and modes of application, has had many trials, but never with any striking results. Hypnotism and suggestion have been advocated, and it is not unlikely that in the hysterical forms they may meet with some success.

There are certain complications of epilepsy the management of which we may here briefly notice. *Prolonged* **coma** following an epileptic attack may require the application of an ice-bag to the head, or a blister to the nape of the neck, or the withdrawal of a few ounces of blood if there is evidence of cerebral congestion. On the other hand, high arterial tension, with a probability of great cerebral anæmia, would indicate the hypodermic injection of nitro-glycerine.

The **status epilepticus,** in which the convulsion passes into coma, and coma into renewed convulsion, without any recovery of consciousness, is often observed in asylums for the insane. It is a very serious condition, the mortality attending it being as great as 50 per cent., and active treatment is necessary to prevent a fatal result. *Chloral*, given by the rectum, 30 to 60 grains every hour, is a common expedient; some inject it hypodermically to the extent of 30 or 40 grains. This succeeds in some cases, but also often fails. It is advisable at the same time to give stimulating enemata to prevent too great cardiac depression. In cases attended with hyperpyrexia Dr. Mott suggests the use of the cold bath. We have used it with good effect.

Inhalations of *ether* and *chloroform* may be given for the immediate arrest of the convulsions, and to prevent exhaustion until other remedies act. *Amyl nitrite* has been warmly advocated by some, and found useless by others. The same may be said of large doses of potassium bromide.

Hypodermic injections of *sulphate of morphine* ($\frac{1}{3}$ grain) and *sulphate of atropine* ($\frac{1}{100}$ grain) have occasionally been found useful, but there is risk of causing serious cardiac depression with large doses of morphine.

Hyoscine hydrobromide, $\frac{1}{100}$ to $\frac{1}{80}$ grain, hypodermically, if great cardiac asthenia does not counterindicate its use, has been found very efficacious in arresting convulsions and in inducing sleep.

A combination of *hydrobromate of conine* ($\frac{1}{100}$ to

$\frac{1}{40}$ grain) with sulphate of morphine has been greatly praised for its efficacy in stopping the convulsions and bringing on a prolonged sleep.

The patient's strength must be maintained and the cardiac action supported by passing into the stomach, through the nasal tube and funnel, eggs, milk, stimulants, and quinine ; and hypodermic injections of strychnine if necessary.

Epileptic mania and *epileptic dementia* require asylum treatment.

Finally, a few words must be said on the question of the **surgical treatment** of epilepsy.

As to the relief afforded by operation in epileptic cases, we have the testimony of Prof. J. W. White in his able paper on "The Supposed Curative Effect of Operations, *per se*," showing conclusively that the mere performance of an operation is *of itself* sufficient to produce, at any rate for a time, great relief. He refers to ninety cases of trephining in which nothing abnormal was found, yet great amelioration followed the operations, and two cases were apparently cured, the influence in these cases being doubtless psychic. But most authorities agree with Gowers in thinking this operation unjustifiable in all cases of *idiopathic* epilepsy. "Even in cases associated with idiocy, in which increased tension is supposed to have resulted from premature closure of the sutures, the effects of this operation have been generally unsatisfactory."[*]

There, are, however, cases of epilepsy directly referrible to some injury to the skull, in which no hesitation need be felt in counselling operation. If there is an external scar which is tender, and especially if an *aura* starts from the scar, the effect of removing the scar should be tried before trephining, especially if no depression or injury of the skull is discoverable. But if the injury is situated over a known centre, and the convulsions are limited to the group of muscles corresponding to that centre, the skull may be trephined and that centre removed. As a matter of fact, the results are extremely disappointing, and not unfrequently the patient is worse off than he was before. In addition to his fits, which still recur, he has lost his aura and perhaps the power of some movements.

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[*] "Epilepsy," p. 308.

But it is in cases of organic epilepsy without evidence of injury to the skull, the cases which Horsley has termed "focal epilepsies," that some difference of opinion exists as to the propriety of operation. Gowers holds that if the fits are local and partial, and if there is good ground for thinking there is disease that can be completely removed, then operation is justifiable; but if the convulsions are widely diffused, and extend to the other side of the body, the probability of benefit is too small to justify the very considerable risks of the operation. He considers that even if the primary lesion be removed the stability of nerve cells has been so disturbed that discharges will start from other cells. "Operation," he says, "should never be thought of in a case of idiopathic epilepsy in which the fits begin locally, because it is certain that the discharging tendency is widespread, and almost certainly adequate, in other parts, to cause fits." Oppenheim considers that if cranial lesion has preceded the epilepsy, trephining may be beneficial, firstly, when the attacks resemble those of cortical epilepsy, and secondly, when the cicatrix is over the motor zone. He hesitates to accept the view of Horsley and others that "not only the bones, the cicatricial meningeal tissue, the cysts, etc., must be extirpated, but also the cortical centre from which the irritation arises."

He concludes generally that the results of operations in traumatic epilepsy are not very encouraging, and he agrees with Von Bergmann that in most cases the effect of the operation is but temporary. He quotes Von Bergmann as disapproving of operative procedures in traumatic cases whose course resembles that of true epilepsy, and thinks they are not justifiable in cases of the psychic equivalents of epilepsy, even when a cranial injury has preceded.* It cannot be doubted that enthusiasm with regard to the surgery of epilepsy has recently undergone considerable abatement!

ADDITIONAL FORMULÆ

Combination of bromide and atropine

℞ Potassii bromidi, gr. xv.
Atropinæ sulphatis, gr. $\frac{1}{60}$.
Aquæ ad ℥j.

M. f. haust. To be taken three times a day. (*Landell.*)

Combination of bromide with intestinal antiseptic (to avoid unpleasant symptoms of bromism)

℞ Potassii bromidi, ʒjss.
β-Naphthol, ʒj.
Sodii salicylatis, ʒss.

M. et divide in doses iij. A dose three times a day. (*Féré.*)

Prescription for the mixed bromides

℞ Ammonii bromidi
Sodii bromidi } āā ʒijss.
Potassii bromidi
Aquæ ad ℥viij.

M. f. mist. One to two tablespoonfuls for a dose. (*Dujardin-Beaumetz.*)

Combination of bromides and iodides

℞ Sodii bromidi
Potassii bromidi } āā ʒiij.
Ammonii bromidi
Potassii iodidi } āā ʒjss.
Ammonii iodidi
Ammonii carbonatis, ʒj.
Tincturæ calumbæ, ℥jss.
Aquæ ad ℥viij.

M. f. mist. A teaspoonful, in water, before each meal and at bed-time. (*Brown-Séquard.*)

Atropine and hyoscyamine pills

℞ Atropinæ sulphatis, gr. $\frac{3}{4}$.
Hyoscyamine, gr. $\frac{1}{3}$.
Pulveris et extracti glycyrrhizæ, q.s.

Ut f. pil. lx. One night and morning. (*Benedikt.*)

Combination of anti-epileptic remedies

℞ Strychninæ sulphatis, gr. j.
Extracti ergotæ fluidi, ℥jss.
Liquoris arsenicalis, ʒij.
Sodii bromidi, ℥jss.
Tincturæ digitalis, ʒiij.
Aquæ menthæ piperitæ ad ℥iv.

M. f. mist. A teaspoonful in half a tumblerful of water before food. (*Hamilton.*)

Combination of antipyrin and ammonium bromide

℞ Antipyrin, ʒij ad ʒiv.
Ammonii bromidi, ʒiv ad ℥j.
Aquæ cinnamomi ad ℥iij.

M. f. mist. A teaspoonful three times a day. (*Potts.*)

To diminish severity and frequency of convulsions

℞ Morphinæ sulphatis, gr. jss.
Tincturæ veratri viridis, ℥ss.
Aquæ, ℥ss.

M. Twenty minims hypodermically during or before a convulsion. (*Mordough.*)

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* "Diseases of the Nervous System," p. 784.

For epileptic attacks following suppression of menses

℞ Extracti nucis vomicæ, gr.x.
Pilulæ aloes et myrrhæ, ʒij.
M. et divide in pil. xxxvj.
One or two twice a day.
(*Copland.*)

Borax mixture for epilepsy

℞ Boracis, ʒiij.
Glycerini, ℥j.
Aquæ ad ℥iij.
M. f. mist. (Dissolve the borax in *warm* glycerine.) A dessertspoonful three times a day. (*Finlay.*)

Stramonium and hydrobromic acid in epilepsy

℞ Extracti stramonii fluidi (U.S.P.), ♏lx.
Acidi hydrobromici diluti, ℥j.
Syrupi, ℥j.

M. Begin with half a teaspoonful doses and continue until physiological effects of stramonium appear.
(*W. C. Wade.*)

CHAPTER VII

TREATMENT OF HYSTERIA AND NEURASTHENIA

Hysteria—Symptoms (1) of Convulsive Forms; (2) of Non-Convulsive Forms—Paralyses—Contractures, etc.—Hyperæsthesia—Anæsthesia—Neuralgia, etc.—Causation—Educational Influences, &c.—*Treatment* (1) of the *Hysterical State*—Hygienic—Medicinal Treatment should be directed to the Relief of Disordered Functions—Antispasmodics—Methylene Blue—Bromides: Indications and Counter-indications for their Use—Morphine—Chloral—Hydrotherapy—Sea-bathing—Electricity and Massage—Hypnotism—(2) Of the *Convulsive Attacks*—(3) Of *Particular Symptoms*—Contractures—Paralysis—Aphonia—Hysterical Joints.

Neurasthenia—Symptoms—The "Rest Cure"—Indications and Counter-indications—*Anorexia Nervosa*—Methods of Applying the "Rest Cure"—Isolation—Diet—Massage—Electricity—Tonics—Schedule. Additional Formulæ.

Hysteria

The vast number of morbid phenomena which it is possible to gather together under the common designation **hysteria** renders any attempt at a comprehensive, yet concise, account of its nature, causes, and treatment a task of some difficulty. As, however, the therapeutic side of the question is now our chief concern, we must not be expected to enter into elaborate details of the various functional disturbances, mental and physical, which a full consideration of this disease would necessitate. Since the commencement of the remarkable and minute observations of Charcot and his followers in the study of the hysterical state, and especially of those forms of hysteria grouped by Charcot under the title of *grande hystérie*, the literature of this branch of practical medicine has been enriched by a mass of contributions, the barest abstract of which would occupy a volume.

Perhaps as good a definition of hysteria as can be offered is that given by Oppenheim, who defines it as "a *psychosis*, which does not express itself by disorders of the intellect, but in defects of character and emotional disturbances, whose real nature is hidden under an almost unlimited and varied number of *physical* symptoms of disease."*

We must, in this place, confine ourselves to the consideration of those definite symptoms and manifestations which call for equally definite remedial measures, as well as of the *general* morbid condition out of which they spring.

We may conveniently divide those symptoms into (1) those of the *convulsive* forms and (2) those of the *non-convulsive* forms.

1. The **convulsive** forms include that common manifestation of hysteria—the hysterical "*fit.*" Often, after some unusual emotional disturbance attended with laughing or crying, and accompanied by a very characteristic symptom, the "*globus hystericus*," *i.e.* the feeling of a ball rising into the throat and causing a choking sensation, the patient becomes attacked with more or less violent convulsions and *apparent* unconsciousness. The convulsive movements are clonic and irregular, and usually subside quickly. They are often succeeded by emotional manifestations, by abdominal distension, and by the passage of a large quantity of clear urine. Attacks of this kind assume all degrees of severity and duration, and may be followed by great mental and physical exhaustion.

The graver forms, the *grande hystérie* of Charcot, are comparatively rarely seen in England, and would seem to be almost restricted to the Latin races. The most varied symptoms and manifestations, especially the occurrence of convulsive attacks closely resembling epilepsy, have been observed and recorded in these forms, which we have not space to detail here.

2. In the **non-convulsive** forms again we

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* "Diseases of Nervous System," p. 661.

encounter an immense variety of morbid phenomena. We can only refer to the chief of these.

One of the most striking is the occurrence of local **paralyses.** "There is no type or form of organic paralysis which may not be simulated by hysteria" (*Osler*). Paraplegia is more common than hemiplegia. Monoplegia and aphonia are frequently met with. Mutism also occurs, but less frequently. Retention of urine is an occasional accompaniment of hysterical paraplegia.

Contractures, affecting certain groups of muscles and causing lameness and deformities, have been specially studied and described by Charcot.

Clonic and *rhythmic* spasms, leading to odd rhythmic rotatory, bending, or other movements, are not rare.

Tremors, with or without paralysis and contractures, may also be hysterical.

Disturbances of sensation are also common.

Anæsthesia, and particularly *hemi-anæsthesia*, has often been noted. With hysterical hemi-anæsthesia, loss of taste, smell and hearing on the same side is very common, and contraction of the visual fields is generally observed as well. *Hyperæsthetic* and *neuralgic* states are very frequent in hysteria. Increased sensitiveness in the ovarian regions and over the cardiac apex and pain in the back are frequent. Gastralgia and enteralgia are often hysterical. Morbid affections of the special senses, and especially retinal hyperæsthesia, are common.

Hysterical dyspnœa, cough, and hiccough are occasionally met with. Vomiting, aggravated flatulence, loss of appetite (the extreme form of this, named by Sir William Gull *anorexia nervosa*, we shall consider under neurasthenic states), obstinate constipation, palpitations, pseudo-angina, flushings, and sweatings, are also frequently manifestations of hysteria. *Hysterical affections* of the *joints*, especially of the knee and hip, have long been recognised and described by surgeons.

Mental and *moral* perversions, often of the most serious nature, form, perhaps, the most distressing features of the hysterical state.

The occurrence of pyrexia and hyperpyrexia in hysteria requires further elucidation. Some very high temperatures have been reported, 108° F. to 113° F., but they have not been attended by those changes in the pulse, the respiration, and the urine which we expect to find in fever. In such instances the daily range is very wide, and the rise of temperature has sometimes been limited to one side of the body!

It was forcibly and truly said by Dujardin-Beaumetz that "hysteria, by its strange manifestations, has suppressed the word '*impossible*' from pathology," and Oppenheim truly observes there is "one characteristic of hysteric symptoms always present which serves to distinguish them: *their dependence upon and reaction to psychic influence.*"

Such, then, being a brief outline of the various manifestations of hysteria, what, we may ask, do we know of its **causation**, and does that knowledge afford us any indications for its prevention and cure?

Although cases of hysteria are occasionally observed in the male, it is undoubted that the female sex is a strong predisposing cause; the old idea, however, that it was entirely referrible to uterine disorder is no longer tenable. Hereditary predisposition is a common factor, so is alcoholism in the parent.

The age of puberty is another predisposing cause; and we may often have the opportunity of watching the wayward, emotional, uncontrollable child pass at puberty into the hysterical woman; and this and other observations give a basis for the belief that, in a considerable number of cases, sexual disturbances and morbid states of the generative organs have a causal influence. Masturbation and sexual excesses are undoubtedly exciting causes; and ovarian hyperæsthesia has been noted by Charcot and others in all the serious forms.

Race certainly appears to have great influence in the production of the severer forms; and the study of *grande hystérie* could scarcely have been carried out in England for lack of material. The more emotional and sensitive Latin races contribute chiefly to this form of the malady. Jews also are especially liable to hysteria.

Faulty educational methods have been justly believed to have much to do with developing and fostering the tendency to hysteria, and this is especially likely to be the case in the offspring of neuropathic parents. The encouragement, by undue indulgence, of personal vanity, self-consciousness, and want of self-control in children of emotional and neurotic temperament is undoubtedly a fruitful cause of hysteria. The frequent absence of any proper attention to the *physical* education of young girls, to the development of their muscular system, by suitable gymnastics and out-of-door exercises, their too close confinement to school studies in some cases, their precocious introduction to exciting and erotic literature in others, are evils tending in the same direction.

The comparatively infrequent occurrence of the graver forms of hysteria amongst country-bred girls who have been early habituated to out-of-door exercises, to cold bathing, and to wholesome habits, mental and physical, indicates clearly enough the direction that should be taken in the application of preventive measures. Home education for girls is thought by some to exercise a predisposing tendency to this disease, and so, doubtless, it does when the parents are weak and indulgent, or the mother has herself shown tendencies to hysterical manifestations; the influence of example having a powerful predisposing effect. But when home influences are good we consider it the best place for a girl's education.

Anæmic conditions and defective nutrition appear to act, in some instances, as predisposing causes; but these are states which predispose to nearly every form of disease, and which always demand remedial treatment. Hysteria, however, may often be seen to occur in the robust and plethoric, and in such cases we should look to menstrual disturbances, or conscious or unconscious sexual excitement, as frequently at the root of the attacks.

Emotional shock and mental and physical strain, such as disappointment in love, domestic unhappiness, loss of social position, anxious nursing, grief, fright, etc., are amongst the commonest exciting causes of hysteria. Oppenheim speaks of the "nerve-shattering influence of psychic traumata—the pain which man gives to man."

Attacks of hysteria sometimes follow acute illnesses, accidents, and injuries; and the existence of actual disease of the generative organs often leads to hysterical manifestations.

Finally, a note of warning must be sounded with regard to the undoubted occurrence of hysterical phenomena in conditions of organic disease, especially in relation to disseminated sclerosis. It is becoming more and more certain that the latter disease may be, and often is, ushered in by a series of clinical manifestations which have every appearance of being hysterical in origin and which resemble functional phenomena in their ready response to suggestive methods of therapy. It follows, therefore, that every hysterical subject, especially those in whom local palsies are prominent symptoms, should be frequently and carefully examined for evidence of organic disease.

In approaching the consideration of the **treatment** of hysteria we must bear in mind what Dujardin-Beaumetz so well expressed, viz. that "hysteria, by its very nature, escapes all precise and scientific therapeutic inductions, and for *two* reasons: *firstly*, from the preponderating part which the imagination plays in this loss of balance of the nervous functions, so that there, where the learned, conscientious, patient and devoted physician will fail, the most barefaced charlatan will easily succeed, hysteria being, in fact, the nursery of surprises and miracles; and *secondly*, because the hysterical patient loves to *deceive* those around her. . . . In short, in this neurosis everything may fail and everything may succeed."* The malady, in its origin, is essentially psychic and emotional, and *moral control*, therefore, must enter largely into its successful management.

It will be convenient to consider 1, the general treatment of the hysterical state; 2, the treatment of the convulsive attacks; and 3, the treatment of particular symptoms.

1. Harsh treatment should never be adopted or encouraged; make the patient see that you thoroughly understand her condition, and that the remedies you propose will be carried out firmly but kindly. Demand absolute trust and confidence from her friends, and, failing to obtain this, assure them that your services are useless.

In considering, first, the **hygienic** management of such cases, we have already alluded to the need of educational precautions in the training of children with neurotic tendencies. We have referred to the importance of free exercise in the open air, riding, boating, swimming, and of suitable gymnastic training of the muscular system. All that appeals strongly to the emotional element should be avoided; "every tendency to sentimentality should be repressed"; intellectual tasks should be light and school hours short, imaginative literature should be put in the background, and interesting historical, biographical, and descriptive works should take its place. Some physicians object to the study of the piano, and especially of the organ, and we have ourselves seen numerous instances in which the cultivation of music has seemed to excite the sensuous emotions and to foster hysterical tendencies. Dujardin-Beaumetz saw a special danger in the study of the organ, and stated that he had seen much hysterical excitement provoked by it, a result to be attributed, he thought, "not only to the penetrating harmony of its sounds, but also to the movements of the lower limbs in working the pedals of the instrument." What is termed the "religious education" of such children should be approached with great caution and reserve, lest the foundation be laid of future religious ecstasy, mysticism, or melancholia, which often forms so troublesome a part of the mental manifestations of hysteria. Removal from the family circle, when the disease has actually appeared, is generally advisable.

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* "Clinique Thérapeutique," vol. iii., p. 141.

The **diet** should be simple, abundant, and supplied regularly, and at not too long intervals, as is frequently the case in boarding-schools. All strong stimulants are best avoided, and the hysterical should not indulge in strong tea or coffee, or exciting wines and liqueurs. In some anæmic cases a little sound, red wine with water may be of use as a tonic.

In arranging the mode of life of young persons predisposed to hysteria we should remember that some form of distraction or congenial occupation is necessary, and while the excitement of an excess of social gaiety is harmful, the *ennui* and vacancy of a dull, unoccupied life are very prone to give rise to hysterical manifestations, favouring, as they do, injurious habits of introspection and self-consciousness. In Zürich and elsewhere "institutions of manual labour intended for and adapted to the treatment of such cases have lately been established."*

It is necessary to watch carefully the occurrence of the menstrual periods, which greatly predispose to hysterical attacks. That unsatisfied sexual appetite often unconsciously provokes these attacks, especially in the robust and plethoric, cannot, we think, be doubted, and it is in such instances that our advice as to the propriety of marriage is sometimes sought. When there is nothing in the antecedents of the patient inconsistent with a future of good health, and when other circumstances are not unfavourable, we should not exceed our duty in pointing out to parents that they often act injudiciously in opposing or postponing unions which, from the point of view of health, it would be wiser to permit; on the other hand, there are cases in which to counsel marriage would be, as has been well pointed out, to condemn a man to a life of trouble and misery in order to procure a benefit which is altogether problematical.

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* Oppenheim's "Diseases of Nervous System" (Mayer's translation), p. 697.

In passing on to the examination of the **medicinal** treatment of hysteria, we must state at the outset that we regard drugs simply as useful auxiliaries in the management of certain phases, and in the control and relief of certain symptoms and complications, but as in no sense directly curative of this malady. For example, preparations of iron may be valuable in removing co-existing anæmia, aperient medicines are often indispensable to relieve the very troublesome constipation which is so common an accompaniment of hysterical states, and so provocative to their continuance unless duly attended to, and astringent vaginal injections may be needed to arrest leucorrhœal discharges. Similarly, all disorders of function must be sought out and relieved by appropriate *treatment*, for just as we see that in epilepsy the removal of carious teeth may aid in suppressing epileptiform seizures, so the appropriate treatment of some local uterine or other malady will frequently be attended by great alleviation, or even entire removal, of hysterical states.

It was at one time the practice to use a variety of so-called antispasmodics, such as musk, asafœtida, galbanum, valerian, castor, etc., for the relief of hysteria. These have mostly gone out of fashion. Valerian, however, is undoubtedly useful in controlling some of the minor hysterical manifestations, and the valerianate of zinc is really a valuable remedy, especially in those forms of hysteria with hypochondriacal tendencies.

One or two grains of this salt should be given in a coated pill (to cover the unpleasant odour) after food three times a day, and in hysteria in the male, a state almost always attended with despondency and signs of nervous exhaustion, the addition of $\frac{1}{60}$th grain of phosphorus to each pill often acts extremely well. Fagge stated that he had found these valerianate of zinc pills "most effective in removing aphonia, hemianæsthesia, and hysterical hemiplegia." Asafœtida also has been commended, in doses of 5 grains every three or four hours.

Pitres has reported remarkable cures from the administration of *methylene blue;* such results are doubtless attributable to the patient's surprise at the effect of the drug, as it colours the urine blue. It may be given in coated pills, one or two grains for a dose.

Considerable difference of opinion exists amongst different authorities as to the value of the *bromides* in hysteria. French physicians, who have undoubtedly to treat many more of the severer forms of hysteria than English physicians, rely greatly on the bromides, whereas some of the latter regard them as of little use. We are ourselves convinced that they are of great value in the detailed management of hysterical cases, although we are not disposed to regard them as directly curative; and while they are, we think, distinctly indicated in certain cases, they are as clearly counter-indicated in others.

They are counter-indicated in those cases that are associated with great physical and mental depression, in those lachrymose cases dependent on troubles, worries, and anxieties, and quite independent of any sexual excitement. But even in such cases an occasional dose of sodium bromide with aromatic spirit of ammonia and chloroform water at night to relieve sleeplessness often has a very beneficial general effect.

They are indicated, and are of the greatest possible use, in the stronger and more robust patients, with much nervous agitation and sleeplessness, and with distinct evidence of sexual excitement.

Their sedative effect on the cerebro-spinal nervous system and their specially anaphrodisiac action render them most valuable calmative agents.

The mixed bromides as recommended by Charcot act best, and a dose of 20 to 30 grains may be given in a tablespoonful of chloroform water night and morning, or the night dose only may suffice.

The bromides should not be given in large doses, nor continuously; they are most useful at the menstrual periods.

Some physicians who are not favourable to the use of bromides have advocated the administration of opium, morphine, and chloral. Of the power of these drugs to quiet and calm the nervous symptoms, and to produce sleep, no one can have any doubt; but the remarkably soothing effect of opium or morphine brings with it a most dangerous craving for the drug. The dread of hysterical, emotional patients is not so much of pain or of physical discomfort as of *ennui* and weariness, and for this they find in morphine an effectual remedy; while the certainty of getting sleep from chloral, if they take it in large enough doses, brings with it also a craving for that drug.

We do not say that morphine or chloral may not occasionally be given with advantage in hysterical cases, but their administration should be reserved for the medical attendant himself, and not entrusted to the patient's friends.

It is important to be aware of the fact that hysterical patients present extraordinary differences in their sensitiveness to the action of medicines; some are remarkably affected by quite small doses, and others require enormous doses in order to produce any decided effect. They may be said to be subject to therapeutic as well as to cutaneous hyperæsthesia and anæsthesia. Oppenheim mentions the case of one of his patients who had an action of the bowels whenever she gave a dose of castor oil to her child, but when she took it herself it had no effect! Ordinary aperient drugs constantly fail with the hysterical. Cold water enemata will sometimes succeed, and so will electrical treatment combined with abdominal massage, faradisation or galvanic faradisation of the abdomen, or intrarectal electric treatment in very obstinate cases.

From *medicinal* we pass to the consideration of other methods of treatment. **Hydrotherapy,** the systematic application of baths and douches to the treatment of hysterical conditions, has been attended with considerable success.

The use of prolonged hot baths, with some aromatic plants infused in the bath, such as valerian and the blossom of the lime-tree, has proved of great service in allaying the states of nervous excitement of hysterical patients. The patient should remain in the bath, which should be maintained at a uniform temperature, for one or two hours at a time. The inhalation of the odorous emanations from these aromatic substances is believed to increase the soothing effect of the long immersion.

The application of spinal douches has been found of the greatest value in the treatment of hysteria, having, when fitly applied, not only a soothing, but also a distinctly bracing and tonic effect on the debilitated nervous system. The douches should be in the form of *spray*, and they should *never* be given *cold*, but *always warm* or tepid (80° to 85° F.), at the commencement of the treatment. After a time, alternating douches, warm and cold by turns (Scottish douche), may be given ; but it is necessary to note carefully the effect on the patient, so as never to give rise to too great excitement. The douche must be given so as to avoid the patient's head, and should never last more than thirty seconds. This treatment is best carried out in establishments adapted to the purpose, such as those at Matlock, Ilkley, Malvern, Pitlochry, Crieff, etc., in England and Scotland ; at Passy, close to Paris ; at Champel, or Divonne, near Geneva ; at Aussee, in Styria ; at Gérardmer, in the Vosges ; and in numerous other attractive localities.

Treatment in these institutions has the further advantage of removing patients from their habitual *entourage*, and often from moral influences not conducive to their cure.

Sea-bathing has been advocated by some English physicians, but it was protested against strongly by Dujardin-Beaumetz. He stated that he had always seen sea-air and sea-baths set up a great amount of excitement, and aggravate notably the nervous sufferings of hysterical patients, and Oppenheim also remarks that "sea-baths are not well borne by hysteric individuals." We should certainly not recommend sea-bathing in well-developed hysterical states; but we should hardly be disposed to prohibit it in the case of young girls with simply a hysterical predisposition, who are fond of swimming and sea-bathing. No doubt the friends of such young persons should be cautioned against the possibility of sea-bathing causing nervous excitement, and it should be at once discontinued on any signs of this appearing.

Of the value of **electricity** and **massage** in the treatment of some forms of hysteria there can be no doubt. Jacoby* maintains that it does not cure the disease, although it may suppress, for a time, its manifestations. He observes: "Whenever such a symptomatic cure has been effected by means of electricity alone, the cure is due to *suggestion* and not to the electric current, and whenever an entire or proximate cure of the disease itself has been brought about, this has been done, not by means of electricity alone, but through a judicious employment of a combination of psychic and physical remedies. . . . The physician, in electricity, has one of the most efficient carriers of suggestion."

To the application of **hypnotism** and **suggestion** to the treatment of hysteria, we must own we look with little sympathy and less confidence. That it may produce apparently remarkable results, in many hysterical cases, is only what we should expect from the very nature of the disease. That it may replace one phase of deception, conscious or unconscious, by another is probable; but we are disposed to regard the practice of hypnotism as tending to develop rather than repress abnormal and morbid nervous manifestations. Its sphere of usefulness seems to us to be practically limited to the suppression of evil habits, alcoholism, etc., in the hysterical, and for this purpose hypnotic suggestion appears to have been of service in some cases. In most other instances, however, we should prefer, as Jacoby suggests, to use electricity as the carrier of suggestion. We shall refer to the *general* use of electricity again when we treat of the "rest cure" in cases of neurasthenia.

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* Cohen's "System of Physiologic Therapeutics," vol. ii., p. 169.

2. In the next place, we pass on to consider the **treatment** of the **convulsive attacks.** In the slighter attacks no active treatment is needed. It is only necessary to loosen any tight garments, and to place the patient on a bed or couch, and leave her *quite alone;* or she may be, when it can be done conveniently, watched without her knowledge; but of this we should be *quite sure.* If she is left alone, without notice or sympathy, the hysterical convulsions will soon come to an end. Free affusion with cold water is a tried remedy, and the mere mention of it will often suffice to bring the patient round. It may be dashed against the face, again and again; or the patient's head and shoulders may be brought over the edge of the bed, and cold water poured over them from a height. Another method, suggested by Dr. Hare, is to prevent the patient from breathing for a time by compressing the mouth and nose. She will soon make efforts to relieve herself from this restraint, and the strong and deep inspiration she will then make is often followed by relaxation of the spasms and the cessation of the fit. The application of strong ammonia to the nose (not, however, without care, else great irritation may be provoked) is a very useful measure, as it may often be relied upon to distinguish between epileptic and hysterical convulsions.

The threat of the application of the *actual cautery*, or of a strong faradic current, and preparation for the operation, may promptly lead to a restoration of calm and consciousness.

Hysterogenic zones.—In the treatment of the more severe and intractable forms, Charcot introduced the method of applying *compression to the ovary*, or rather, we should say, in the ovarian or iliac region, because it does not appear to be necessary that the pressure should be made precisely over an ovary. The closed fist should be pressed firmly and strongly into the iliac fossa, and the compression maintained for a certain time. It is remarkable that pressure over this region is capable both of exciting and arresting the convulsive attack, and this remark applies to other so-called **hysterogenic zones,** as the apex region of the heart.

The application of the continuous *electric* current will often diminish the duration or cut short these convulsive attacks. One pole is placed on the forehead and the other on the epigastrium, or some other part of the body. A sudden change in the direction of the poles has been found particularly efficacious in arresting the attack. The current must not be very strong, 6 to 8 or 10 milliampères being sufficient.

It has been suggested that if a hysterogenic zone be found on the skin, whence the spasm may be produced, it should be protected from all contact.

3. In the third place, we proceed to consider the treatment appropriate to particular symptoms.

Contractures.—These are amongst the most troublesome of hysterical manifestations. They are usually accompanied by some disturbance of the cutaneous sensibility in the form of either anæsthesia or hyperæsthesia. These spasmodic contractions may appear suddenly at the end of a convulsive attack and remain till the end of another attack, when they will suddenly disappear. They may attack almost any group of muscles. In case of the existence of any doubt as to their true nature, the patient should be brought under the influence of chloroform or ether, when the contraction will disappear. Hysterical abdominal tumour is of this nature, and will disappear on the administration of an anæsthetic. Forcible compression or traction on the contracted part, and the application of induction currents, together with *appropriate treatment of the general constitutional state* on the principles already laid down, may succeed in overcoming some of those manifestations. Weir-Mitchell * quotes an obstinate case of this kind, in which, after traction and electricity and other measures failed, a cure followed the fullest hypodermic injection of atropine that the patient could bear thrown directly into the rigid muscles. As soon as the atropine produced relaxation of the limb, it was manipulated and moved in different directions, upwards, downwards, and sideways.

Attempts forcibly to extend a spasmodically flexed limb may give rise, as Weir-Mitchell has pointed out, to general convulsions, and must, of course, then be desisted from; he also states that he has thrice seen section of the tendo Achillis prove valuable.

Paralysis of various sets of muscles, and of various sensory areas, are met with in hysterical states. Moral or coercive treatment will suffice in some cases to cure them. We once saw a case of hysterical paraplegia in a young girl, the true nature of which had not been apprehended. She had been kept in bed in hospital for six months. Chloroform was administered for diagnostic purposes, and as she passed into the stage of excitement she began to throw about the "paralysed" lower extremities. We had her, after this, got out of bed daily and placed in the middle of the ward, where she was left to find her way back to her bed; this she soon did, and in a very short time left the hospital perfectly well. There was in this case complete cutaneous anæsthesia of both lower limbs. In another case of hysterical partial loss of power of the lower limbs in a hospital out-patient, we insisted on her putting aside her crutches and walking home without them. This she did, and never used them again. Oppenheim mentions a case in which resection of the knee had been decided upon. "She came to me," he says, "on two crutches, and left me in a quarter of an hour without them"! But there are few cases so easily cured as these. The application of electricity, of massage, and of the methods of hydrotherapy is of great value in the treatment of these hysterical paralyses. Some have found putting a narrow strip of blistering plaster completely round the limb of great service.

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* "Lectures on Diseases of the Nervous System," p. 126.

Weir-Mitchell recommends massage and electricity together with careful attention to any other functional disorders that may co-exist; *e.g.* in a case of motor and sensory paraplegia, finding that the patient suffered from acid regurgitations, he put her on an exclusively milk diet containing 2 grains of sodium bicarbonate to the ounce. "Secure," he says, "to such cases a quiet, unemotional life, and with the renewal of healthy nutritive functions the sensory failures will in turn cease to exist." "The cures of those cases are to be made by a slow, steady, hopeful training of the will-powers through every-day effort, which needs some caution not to err in the way of excess . . . a case is urged and scolded, and teased and bribed and decoyed along the road to health . . . this is what it means to treat hysteria."*

Oppenheim has found the faradic brush especially efficacious against the anæsthesia, and he has also found the application of a large horse-shoe magnet or electric sparks from a static machine do good when other measures fail. For the headache, backache, and neuralgia attacks he recommends the constant current, applied to the seat of the trouble. He has also found the wearing of an ice-bag efficacious in relieving the backache.

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* "Lectures on Diseases of the Nervous System," p. 36.

The treatment of a common form of hysterical paralysis needs special notice. We refer to **aphonia** from hysterical palsy of the vocal cords. These cases need general tonic and supporting treatment, and the local application of the faradic current to the larynx. One pole is applied externally over the larynx, and by means of a suitable laryngeal director provided with a button for making contact, the other pole may be applied to the interior of the larynx itself; on contact being made, the patient should be firmly commanded to make some sound such as "Ah!" or to say "One, two, three." We have often found touching the neck or face, or even the hand, with the laryngeal pole and making sudden contact, and at the same time commanding the patient to speak, answer quite as well as touching the interior of the larynx. The great trouble in these cases is the tendency to constant recurrence. A pill of 1 or 2 grains of valerianate of zinc twice a day is an excellent aid to other treatment.

For spasm of the glottis an emetic (apomorphine hypodermically) may sometimes have a good effect when other means fail.

The most appropriate treatment of *hysterical joints* is the application of induction currents together with massage, and the setting aside of bandages and crutches.

Gastric symptoms, and especially persistent hysterical vomiting and refusal of food, are best encountered by forced feeding by means of a funnel and tube, such as is used in the feeding of the insane, the latter being, if necessary, passed along the floor of one or other of the nasal passages into the œsophagus and stomach.

In conclusion, we cannot do better than quote the words of Professor Oppenheim: "The basis of the treatment of hysteria is *psychotherapy*. The physician must betray intense interest in his patient, and must gain her confidence without losing his authority. He should not ignore any symptoms of his patient, least of all ridicule or laugh at them, but should constantly assure her of their curability; must even definitely satisfy her of this. The physician must endeavour to distract the patient's attention from her symptoms and seek to strengthen her will-power. Much can be accomplished by tact and a proper understanding of the case. He gains in this way the patient's trust and lays bare the patient's inner life, and shows her the hidden wounds which must be closed before the disease can be cured. It is often necessary to combat single symptoms which particularly trouble the patient. Most of our remedies lose their efficacy after a time, and new methods must constantly be used to win the necessary psychic influence."*

NEURASTHENIA

Closely allied to, and in some cases almost inseparable from, hysterical states are those morbid conditions to which, in modern times, has been applied the term *neurasthenia*.

This term is made, by many authors, very comprehensive, so as to include a great variety of morbid manifestations ranging from the confines of hysteria to the borderland of insanity, and including also under the designation "*traumatic* neurasthenia" all those nervous states which follow "shock," as in railway and other accidents.

This condition of the nervous system is characterised by a combination of exhaustion, or feebleness, and irritability. The symptoms most commonly complained of are sleeplessness, great *muscular debility*, headache and backache; dyspepsia, with loss of appetite, and constipation; mental weariness, incapacity and unrest, and an irritable, capricious, uncontrollable temper.

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* *Op. cit.*, p. 697.

Less constant but frequent symptoms are anæmia, cardiac and vaso-motor excitement, palpitations, sweatings, etc., spinal hyperæsthesia, vague erratic pains, and ovarian tenderness, with other sexual disturbances in both sexes; and in some cases we may encounter also all the symptoms which characterise the hysterical state.

The field of morbid phenomena occupied by these cases is extremely vast, and the literature of the subject as extensive as it is interesting, for owing to the absence of any known and constant *physical* basis to which to refer the manifestations observed, it is sometimes, perhaps, a little difficult to distinguish between romance and reality in the written descriptions of this many-sided malady.

Some authors divide cases of neurasthenia into groups or classes, such as (*a*) the cerebral form, (*b*) the spinal, and (*c*) the cerebro-spinal form,* or according to another author into (*a*) cerebral, (*b*) spinal, (*c*) cardiac and vaso-motor, (*d*) gastro-intestinal, and (*e*) sexual forms,† besides the traumatic group.‡ Oppenheim § thinks these divisions "artificial" and "not practicable," and we are disposed to agree with him. They serve to group symptoms rather than cases.

As to the *etiology* of neurasthenia, all are agreed that *heredity* stands in the first place—the inheritance of a neurotic constitution; and next in order is stress—mental, emotional, or physical strain.

It is a question whether some cases following infective fevers, or associated with gastro-intestinal disorders, do not arise from some obscure *toxic* agency. Sexual vices or aberrations, such as masturbation, etc., are common in the neurasthenic, and certainly aggravate if they do not cause this malady. The effect of physical injury when combined with shock—or shock even without physical injury—as in railway accidents, will give rise to the "traumatic form."

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* Garrett Anderson, "Encyclopædia Medica," vol. viii., p. 328. Art. "Neurasthenia."

† Clifford Allbutt, "System of Medicine," vol. vii., p. 134. Art. "Neurasthenia."

‡ Victor Horsley, Allbutt's "System of Medicine," vol. vii., p. 164.

§ "Diseases of the Nervous System," p. 714.

It is in certain cases of this disease that the **"rest cure,"** devised by Weir-Mitchell, has proved so remarkably successful. But there can be no sort of doubt that it has been applied far too indiscriminately, and that for this, as indeed for any special method of treatment, a careful selection of suitable cases is needful. There are also many great drawbacks to the application of this method; it involves, for a time, complete separation from family ties, and very costly nursing and medical attendance. It is unsuited to the hypochondriacal, for whom forced inactivity is most prejudicial; these rather need enforced activity, with change of scene and environment.

The cases that are especially adapted to the rest-cure are those that Sir William Gull described as cases of *anorexia nervosa* or *hysterica*, in which we find absolute loss of appetite and loathing of food, with quite a phenomenal amount of emaciation. Other suitable cases are those with great loss of moral tone, and a morbid desire for sympathy and attention. Certain distressful mental conditions originating in family worries, in love troubles, or in religious excitement are also often greatly benefited by this method of treatment. It suits women, for obvious reasons, much better than men. Many of these neurasthenic cases originate in a hasty return to the strain and effort attending domestic and social duties after incomplete convalescence from some severe illness; or they arise in a struggle between a mistaken or exaggerated sense of duty, and the physical or mental inability to cope with its demands; or the distress of some unrelieved chronic disease is concealed and is neglected until a serious state of physical and moral debility is induced.

The **"rest cure"** comes to the relief of many of these otherwise intractable cases. The means it employs are isolation, rest in bed, passive exercise, electricity, and a rigidly ordered diet. Women are advised to begin treatment immediately after a menstrual period.

The **isolation** must be very complete. Removal from home and family is essential; no sympathetic relative or acquaintance must be seen; no letters are to be sent or received; and for the purpose a private hospital or home is the best. The only persons allowed to see the patient are the doctor, the nurse, and the masseuse. The nurse should be young and previously unknown to the patient. She must be observant, educated, intelligent, tactful, conciliatory, and discreet. If a nurse does not get on well with the patient she had better be at once changed. The duration of the seclusion must be from six to eight weeks in milder cases, while many months may be needful in more inveterate forms, especially those complicated with hysteria. Towards the end of the period some of the rules may be somewhat relaxed, and a limited number of short letters may be written and received. "Isolation is not a matter of weeks and months, but of results. The results which we desire to obtain are to separate the patient from the habits of long illness, from the too tender solicitude of her family or friends, to restore the enfeebled will-power and strengthen the *morale*, and make the invalid once more able to bear her part in every-day life."*

The amount and strictness of the **rest** must be adapted to individual requirements. When there is evidence of great cerebro-spinal exhaustion, the rest must be most absolute, even to the extent of not allowing the patient to feed herself or to turn herself over in bed. No conversation is allowed. Thus absolute inactivity is assured to the over-strained nerve-centres. As improvement becomes manifest, some relaxation of this rule may be permitted; the patient may sit up in bed for her meals, and after five or six weeks she may sit for ten minutes twice a day in a chair while her bed is being arranged. This sitting-up period is increased gradually to an hour twice a day. A little walking exercise may now be permitted. After ten days a short drive may be taken, the patient being carried in a chair up and down stairs and to the carriage. As some hysterical patients rather shirk this return to relative activity it must be firmly insisted on. After complete recovery, a certain amount of absolute repose daily should be ordered, as an hour after each meal.

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* "Rest Cure for Neurasthenia," by J. K. Mitchell, M.D. Hare's "System of Practical Therapeutics" (2nd edition), vol. i., p. 286.

As to **diet.** In cases of entire loss of appetite, or *anorexia nervosa*, it is best to begin with an absolute milk diet. Skimmed milk only should be used, and at first in quite small quantities at a time. As soon as tolerance of the diet is established, 4 ounces, warm or cold, increasing to 8 or 10 ounces, should be given every two hours.* After four or five days of milk diet a chop is ordered at noon, and the next day, in addition, some bread and butter at supper. Some slight increase of these two meals is slowly made for a few days, and then some more food is given for breakfast. If the patient is digesting well, she soon gets to three full meals a day, and about two quarts of milk. A portion of this milk may then be replaced by some suitable and agreeably prepared and pre-digested food.

Systematic **massage** is another most important part of the "rest cure." It should begin with the first two days of confinement to bed, and should at first consist of "gentle stroking of the whole body for from 15 to 20 minutes, for two or three days, then going on to thorough deep massage of the entire surface of the body and limbs, exclusive of the head and neck, and be rapidly increased in duration to an hour, or an hour and a half, daily." It is, of course, important that the massage should be properly performed; the best test of this "is the patient's power of consuming and digesting food," but if "the patient's weight increases with abnormal rapidity, either the massage is not sufficiently thorough" or the diet needs modifying. A deposit of lithates in the urine must also be regarded as evidence that the patient fails to utilise the amount of food taken. Thorough massage of the abdomen is especially desirable in view of the frequency of obstinate constipation in these cases.

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* Some further minor details will be found in the author's "Food in Health and Disease" (revised edition), p. 466.

Electricity is, according to Weir-Mitchell, the least necessary part of this treatment. A slowly interrupted mild faradic current should be used to the muscles once a day, going all over the body; this produces slight contraction of each muscle and distinctly raises the patient's tone. "After the daily faradisation of the muscles has been completed, in cases in which the spinal centres seem affected the use of the rapidly interrupted current through the spinal cord does good, placing one pole on the nape of the neck and a large electrode on the soles of both feet" (*Mitchell*). This should last for fifteen minutes.

A combination of electricity and massage leads to excessive waste of tissue; it also leads by promotion of digestion and circulation to improved assimilation, so that an excessive amount of food can be consumed to make up for this waste. The final outcome is a great acceleration of tissue changes.

Should any signs of dyspepsia occur during the excessive diets, it should be met by a return to the absolute milk diet for a day or two.

In addition to these measures, good may be obtained from the use of certain medicines to fulfil definite indications. Mitchell recommends in anæmic cases that large doses of the pyrophosphate or lactate of iron, 5 to 20 grains, thrice a day, should be dissolved in the malt extract, as much as 3 ounces of which may be given at each meal; he also proposes a cheap substitute for malt extract, made by adding a teaspoonful of dry malt to 3 ounces of good brown stout.

During the "rest cure" certain troubles may need special treatment. Insomnia may at first need a few nightly doses of some hypnotic to break through the habit of sleeplessness, and sulphonal is, perhaps, the least objectionable. This drug must either be given an hour or two before you desire to induce sleep, 5 or 6 grains every half-hour, or, if *prompt* action is wished for, it is best given in a full dose, 15 to 30 grains dissolved in boiling water and drunk as hot as the patient can swallow it. Trional also is suitable, in doses of 15 to 30 grains. Or the "drip-sheet" may be applied if there is restlessness at night. For the management of the often troublesome *constipation* the reader is referred to what has already been said under that head. Swedish movements are frequently of value in leading the patient again gradually to a life of free muscular exercise. The means of restoration to health, here described, must, during convalescence, only be slowly and gradually quitted, and they will be found, in most cases, to be needed, in a diminished and modified degree, for some time. From six weeks to three months may be taken as the average time needed for this cure. Change to the sea, the mountains, or to the country, in suitable seasons, will be of advantage in confirming the cure. But this "rest" cure is, as we have pointed out, only applicable to a limited group of cases, and its cost makes it impossible for many. We must therefore add some more general directions.

The physician is rarely able to apply *preventive* measures, but if he were they would be of the nature already suggested in what we have said about the training and education of children prone to hysteria. "Everything which strengthens and hardens the young body serves as a protection to the nervous system. Everything which overburdens the mind, stimulates the senses, excites the imagination, arouses the emotions, weakens the body and prepares the way for neurasthenia. Above everything else, however, a backward child should not be forced to study. The child should be guarded and cautioned against masturbation."* If possible, an out-of-door occupation should be sought for such children, and agricultural pursuits are most suitable.

Entire withdrawal from work and enforced inactivity act unfavourably on certain introspective natures. It is better that such a patient should have some employment which shall divert his mind from dwelling on his morbid sensations. "Work," says Oppenheim, "in accordance with his capacity and in proper dosage is a therapeutic remedy of priceless value." In cases dependent upon masturbation it is important, while pointing out clearly the dangers attending this habit, not to *over*-alarm the patient or cause him to take too serious a view of the effects on his constitution—we have known the most disastrous consequences follow such alarmist though well-meant cautions.

With respect to **drug treatment** there is something like a general consent amongst physicians of experience in these cases that *arsenic* is of special value. Clifford Allbutt considers it "invaluable" in gastric cases. It should be given in small doses at first and gradually increased up to 5 minims of Fowler's solution thrice daily after meals, and continued for three or four weeks. It may be combined with small doses of iron in anæmic cases. *Valerian* in the form of the ammoniated tincture or combined with zinc—valerianate of zinc in 2-grain pills twice or thrice daily—proves of much service in many cases. The *hypophosphites* and the *glycerophosphates* of soda and lime are undoubtedly serviceable in some cases; so is a combination of *phosphorus* (gr. $\frac{1}{60}$) and valerianate of zinc (gr. ij.).

The *bromides* are of great service in very many of these cases, if given carefully and with judgment, not continuously, but with interruptions. They may be usefully combined with valerian and nux vomica. Sodium bromide in 15- or 20-grain doses, if given at bed-time, with 60 minims of tincture of hops or 30 minims of tincture of henbane, will often relieve the milder forms of insomnia. We must remember that some of these patients are easily depressed by bromides, especially those suffering from great muscular exhaustion; these must therefore be prescribed with caution.

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* Oppenheim's "Diseases of the Nervous System," p. 717.

Severe attacks of pain, especially of gastralgia, may require an occasional opiate, but we should be very chary in the use of this drug in neurasthenia.

Symptoms of auto-intoxication, from the absorption of toxines from the alimentary canal, point to the need of a mild calomel and saline purgative (the bowels should always be kept freely open), and some intestinal antiseptic, such as a menthol, thymol, or creasote pill, taken after meals. Great care in diet is also needed in these *toxic* cases. Complex meals should be avoided, and great simplicity in the choice of food and the avoidance of excess insisted upon.

Hydrotherapy is of great service in many of these cases, and should be applied in one of the many institutions devoted to this method of treatment, and under the direction of a physician experienced in the management of such cases. It is especially suited to those patients who are not likely to be benefited by isolation and enforced inactivity. The nature and mode of application of the baths, sprays, and douches must be adapted to individual cases at the discretion of the physician in charge.

Appropriate exercises may also be combined with this treatment. Mrs. Garrett Anderson has found it "well worth while to prescribe three or four daily short douches of the neck and face with water of 105° F. or more, and to order the feet to be put into still hotter water for two or three minutes twice a day perhaps, in the afternoon and at bed-time. As the case improves, the morning douching may be done with moderately cold water, till in the end the patient is taking a sitz-bath every morning of 60° F. and a quite hot sitz-bath every night."* We have already alluded to the use of *electricity* in connection with the Weir-Mitchell treatment, and apart from this method it may be employed to good purpose in the treatment of neurasthenia. General electrisation, avoiding strong currents, should be used. "Moderate stimulation of the peripheral nerves being all that is necessary, . . . the symptoms of cerebral and spinal irritation are not infrequently aggravated by the use of strong currents."† At first such application should not be for more than five to ten minutes. After six weeks the treatment should be stopped for six weeks, and then renewed for another six weeks. "The electrostatic bath, the *localised breeze and spray* applied to single parts, especially to the head and spine, will be found useful." The faradic bath is also serviceable. "The feelings of pain in the back and extremities are best treated by means of stabile spinal galvanisation." Jacoby speaks highly of the "head breeze in neurasthenic insomnia," which he has found succeed when "all other forms of electric application have failed."

For further details as to the treatment of *insomnia* the reader is referred to a previous chapter.

Climate and *spa* treatment are often of much service in certain cases—partly for the change of scene and mode of life they bring, as well as for the opportunity they afford of being much in the open air.

Over-stimulating climates will need to be avoided, as they often aggravate the insomnia and nervous restlessness; the high altitudes are therefore not to be recommended, and resorts close to the sea often prove too exciting. Moderately bracing forest or woodland districts, with pleasing scenery, are most suitable. The indifferent thermal spas, such as Gastein, Buxton, and Schlangenbad, have been found of service.

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* "Encyclopædia Medica," vol. viii., p. 338.

† Jacoby, "Electrotherapy," vol. ii. of Cohen's "System of Physiologic Therapeutics." This author truly observes (p. 179): "Under all circumstances should it be remembered that fresh delusions may easily be implanted upon a physically disordered brain, and electricity is one of the agents most capable of doing so."

The *traumatic* cases—especially those following railway accidents and purely neurasthenic, *i.e.* uncomplicated with any physical injury—require much the same kind of treatment as we have already described, the Weir-Mitchell rest-cure being specially suitable for such cases.

Finally, it must never be forgotten that in the management of these cases, as in cases of hysteria, the *personal* factor is a most important one. These patients are highly impressionable, often querulous and critical and not rarely suspicious; the personality of the physician, therefore, tells largely for or against success. He must aim at attaining a wholesome ascendency through a combination of insight, sympathy, and firmness.

SCHEDULE OF FULL "REST TREATMENT."*

Miss A. B. :—

7 a.m. Cocoa. Cool sponge-bath with rough rub and toilet for the day.
8 a.m. Breakfast with milk. Rest an hour after.
10 a.m. 8 oz. peptonised milk.
11 a.m. Massage.
12 noon. 8 oz. milk or soup. Reading aloud by nurse half an hour.
1.30 p.m. Dinner. Rest an hour.
3.30 p.m. 8 oz. peptonised milk.
4 p.m. Electricity.
6.30 p.m. Supper with milk. Rest an hour.
8 p.m. Reading aloud by nurse half an hour.
9 p.m. Light rubbing by nurse with drip-sheets.
3 oz. malt extract with meals; tonic after meals.
8 oz. peptonised milk with biscuit at bed-time, and a glass of milk during the night if desired.
Laxative (cascara), 10 to 30 drops occasionally.
Later, Swedish movements are added after the massage.

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* From J. K. Mitchell's article in Hare's "System of Practical Therapeutics" (second edition), vol. i., p. 298.

ADDITIONAL FORMULÆ

Mixture in hysterical attacks

℞ Tincturæ valerianæ ammoniatæ, ℥ss.
Spiritus ætheris compositi, ℥ss.
Tincturæ lavandulæ compositæ, ℥ss.
Tincturæ hyoscyami, ♏clx.
Aquæ camphoræ ad ℥xij.
M. f. mist. Three tablespoonfuls every two or three hours. (*Ashwell.*)

Pills for hysteria

℞ Extract hyoscyami.
Extracti valerianæ } āā gr. xxv.
Zinci oxidi
M. et divide in pil. l. One or two for a dose. (*French Codex.*)

Pills for hysteria

℞ Gummi camphoræ } āā ʒjss.
Asafœtidæ
Extracti belladonnæ, ʒss.
Extracti opii, gr. viij.
Gummi acaciæ et syrupi, q.s.
Ut f. pil. lx. One to six pills daily. gradually increased. (*De Bregne.*)

Drops for hysteria

℞ Tincturæ asafœtidæ, ʒiv.
Tincturæ castorei, ʒiij.
Tincturæ opii, ʒj.
M. f. tinctura. Fifteen to thirty drops in water for a dose twice or thrice daily. (*German Pharmacopœia.*)

Enema for hysteria

℞ Extracti valerianæ, ʒijss.
Camphoræ, gr. xij.
Vitelli ovi unum.
Tincturæ opii, ♏xx.
Aquæ ad ℥x.
M. f. enema. (*Bourdon.*)

Pills for hystero-epilepsy

℞ Cupri sulphatis, gr. $\frac{1}{5}$.
Argenti nitratis, gr. vj.
Zinci valerianatis, gr. iij.
Extracti belladonnæ, gr. jss.
Extracti glycyrrhizæ, q.s.
Ut f. pil. xx. A pill three times a day after meals. (*Benedikt.*)

Pills for hysterical globus

℞ Asafœtidæ, gr. lxxv.
Extracti valerianæ, gr. xxx.
Extracti taraxaci, q.s.
Ut f. pil. lx. Two pills daily. (*Bamberger.*)

Drops for the same

℞ Tincturæ valerianæ æthereæ, ℥ss.
Spiritus ætheris nitrosi, ʒiij.
M. Fifteen drops in water three times a day. (*Bamberger.*)

Tonic pills in hysteria

℞ Ferri sulphatis, gr. xxxvj.
Sodii bicarbonatis, gr. xxx.
Extracti valerianæ, gr. xxiv.
M. et divide in pil. xxiv. Two pills twice a day.

Pills for hysteria

℞ Zinci valerianatis, gr. xxiv.
Quininæ valerianatis, gr. xxiv.
Ferri valerianatis, gr. xxiv.
Extracti aloes aquosi, gr. xij.
M. et divide in pil. xxiv. One three times a day after food. (*Whitla.*)

Arsenic and iron mixture in neurasthenia with anæmia

℞ Sodii arsenatis, gr. ½.
Ferri et ammonii citratis, gr. lxxx.
Spiritus ammoniæ aromatici, ʒij.
Aquæ ad ℥viij.

M. f. mist. A tablespoonful in water three times a day after meals.

Valerian mixture in neurasthenia

℞ Tincturæ valerianæ ammoniatæ, ʒiv.
Tincturæ sumbulis, ʒij.
Spiritus chloroformi, ʒiss.
Aquæ ad ℥viij.

M. f. mist. An eighth part twice or thrice daily.

PART VIII.—CONSTITUTIONAL DISEASES

CHAPTER I

TREATMENT OF CHRONIC RHEUMATISM AND OF ARTHRITIS DEFORMANS OR OSTEO-ARTHRITIS

SIMPLE CHRONIC ARTICULAR RHEUMATISM—Mode of Origin—Relation to Acute Attacks—Exciting Causes, Cold and Wet—Characteristic Nature of Anatomical Changes—Symptoms—Subfebrile Form. *Indications for Treatment*—1. *Local* Treatment—Counter-irritation—Friction and Movements—Iodine—Stimulating Liniments—Hot Water and Vapour Douches—Analgesic Applications—Sulphur—Ichthyol—Chromic Acid—Electricity—Massage—Hot Baths—"Indifferent" Thermal and Sulphur Springs—Hydrotherapy—Superheated Air—Electric Light and Heat. 2. *Internal* Treatment—Salicylates—Alkalies—Aperients—Potassium Iodide—Colchicum—Guaiacum—Salipyrin—Aspirin—Iron—Arsenic—Treatment of Complex Cases. 3. *Hygienic* Treatment—Food—Beverages—Clothing—Dwellings—Climate.

CHRONIC MUSCULAR RHEUMATISM (Myalgia)—Nature—Symptoms—Lumbago—Torticollis—Pleurodynia—*Treatment*—Rest—Dry Heat—Counter-irritation—Vapour and Hot Baths—Massage—Anodyne Liniments—Methyl-Chloride—Antiphlogistine—Internal Remedies—Diaphoretics—Salicylates—Alkalies—Methyl-salicylate—Ammonium Chloride—Morphine Hypodermically—Acupuncture—Various Modes of Treatment adapted to different Chronic Cases.

ARTHRITIS DEFORMANS, OR OSTEO-ARTHRITIS, OR RHEUMATOID ARTHRITIS—Anatomical Characters—Variety of Forms—Symptoms—Etiology—Infective Origin—Divergent Views as to Curability and Treatment—Therapeutic *Indications*—Removal of Cause—Dietetic and Hygienic Treatment—Tonics—Arsenic—Cod-liver Oil—Quinine—High Frequency—Antitoxic Remedies—Guaiacol Carbonate—Iodide of Potassium—Iodide of Iron—Antistreptococcic Serum—Eliminant Methods—Hot Air—Warm Mineral Baths—Peat Baths—Rest—Anodynes—Massage Counter-irritants—Douche Massage—Bier's Method—Electricity—Weight Extension.

Additional Formulæ.

CHRONIC RHEUMATISM

So much difference of opinion exists as to the precise pathological nature, affinities, and appropriate nomenclature of certain chronic, painful conditions of joints, that it is somewhat difficult, in approaching the subject from the therapeutic point of view, to make it perfectly clear what are the morbid states, or better, what are the particular cases, we are contemplating.

The disease known as acute rheumatism has been, by almost general consent, transferred to the class of acute infective diseases, and its probable microbic origin generally accepted. The term *chronic* rheumatism, as it is commonly understood, can therefore be scarcely regarded as indicating a *chronic* form of the same disease. Our own experience is that chronic rheumatism is an extremely rare sequence of acute rheumatism, and it seems to us quite justifiable to regard these rare occurrences as coincidences, and not as causally related. There is no kind of reason why a person who has been the subject of the disease known as acute rheumatism should not later on be attacked by a chronic joint affection, such as that to which the name chronic rheumatism is generally given. But the word "rheumatism" has entered so largely into the language of the people, as well as that of the medical profession, and more particularly in connection with those cases which are termed chronic, that it would be most inconvenient to discard it. We shall therefore continue to employ it in its usual signification.

Chronic rheumatism may be **articular** or **muscular,** and it is to the treatment of the articular form that we propose first to direct our attention. It is undoubtedly difficult to define, with precision, the pathological and clinical characters of this affection, and to separate it from certain other chronic diseases of joints. We may first explain what we do *not* include under chronic rheumatism. All purely *gouty* inflammations of joints, and all cases of true rheumatoid arthritis, or arthritis deformans, we exclude; and we still think there is left a large class of chronic joint affections which may, at present, be distinguished by the name of chronic rheumatism;

and, as a further qualification, we would call this affection *simple* chronic articular rheumatism.

Many French authors are dominated by a *general* conception of the existence of "arthritism," that is, an inherited diathesis or constitution which determines a tendency to arthritic affections generally, and to which they refer diseases differing so widely as acute gout and arthritis deformans, which, however, they trace to a common origin or diathesis, and between which they see a pathological affinity.

It will appear that the appropriate therapeutic management of those different forms of arthritis differs considerably.

Simple chronic articular rheumatism is most commonly a chronic disease from the commencement, but occasionally, though rarely, it appears to follow an attack of acute or subacute rheumatism, and more frequently the latter. In such instances, one or more joints do not return to their natural painless and healthy functions, but remain subject to more or less pain on movement, although there may be little or no swelling. In other instances, although the chronic joint affection does not immediately follow an acute attack, yet the *tendency* seems to be referrible to a former attack of acute rheumatism which has left behind a rheumatic predisposition; and there is also a well-marked *inherited* liability to such affections in the members of certain families. The most common exciting cause is exposure to cold and wet; it is on that account a very frequent disease amongst the hard-working poor, especially those who have to work in a damp atmosphere, such as woodmen and laundresses. But it is also met with in the upper classes, where its hereditary character is well established. Many who suffer from this complaint in a cold, damp climate obtain complete freedom from their sufferings in a warm and dry climate. A characteristic distinction of this disease is its tendency to attack only one or a very few joints, and, although so chronic in its nature, to cause but little anatomical change in the joints affected —a slight injection of the synovial membrane, perhaps a little effusion, and some thickening of the capsule and ligaments, and adjacent sheaths of tendons. Such are the only anatomical changes in the majority of cases; and under appropriate treatment these changes will, again and again, entirely disappear.

In old cases some erosion of the cartilages is occasionally found, and in affections of single joints some muscular atrophy may occur, but more or less muscular atrophy must naturally follow when a joint goes out of use, as it were, because of the pain attending its movements.

The **symptoms** of chronic articular rheumatism are pain and impaired mobility of the joint. The pain is aggravated by movement, by unfavourable changes of weather, and sometimes paroxysms of pain occur at night; there is usually some tenderness of the joint on manipulation. There may be no swelling of the joint, or the swelling may be only apparent from atrophy of surrounding muscles, but at other times the joint may be more or less swollen from increase of synovial fluid. Another characteristic of cases of this kind is that the stiffness and pain often completely disappear with active or passive movements of the joint.

There is danger in some of these cases, especially if neglected, that ankylosis and deformity may occur, and that the general health may suffer from the enforced inactivity involved.

The **indications** for **treatment** in this disease are (1) to relieve the pain, (2) to restore free movement to the joint and prevent muscular atrophy, (3) to remove if possible the morbid constitutional state on which the local disease depends, (4) to improve the general tone, and (5) to adopt a regimen which may prevent the re-development of the constitutional tendency.

The measures at our disposal in order to respond to these indications may be thus classified :—

1. Local and external treatment.
   (*a*) Counter-irritants, anodynes, and other special agents, (*b*) electricity, (*c*) massage and movements, (*d*) baths, douches, and heated air.
2. Internal and medicinal.
3. Hygienic and regiminal.

1. The great value of **counter-irritation,** or "revulsion," in the treatment of chronic rheumatism has been long established.

Flying blisters, in early cases, are of great use in commencing the treatment. Small blisters about the size of a florin, kept on from two to four hours, should be moved freely about over the circumference of the joint, the object being to produce general injection of the skin rather than a blister; the joint being at the same time enveloped in cotton-wool. After a few days of this treatment, and when those parts of the surface that have been blistered are healed, gentle friction twice daily with the linimentum potassii iodidi cum sapone, and gentle passive movements, should follow. Unless the joint is hot and tender these movements should be steadily increased in extent.

The application of the liquor iodi fortis will frequently produce a blister, and is a very useful form of counter-irritation; a mixture of equal parts of the liniment and of the tincture of iodine is, however, a more convenient strength, especially when the application is entrusted to the patient, as it can be applied for a longer time and the revulsive effect therefore maintained. The cuticle usually comes off after a few daily applications, and then the iodide of potassium liniment can be applied instead. Many forms of stimulating liniment are used with advantage in slighter and more chronic cases. The following is a useful form :—

℞ Linimenti camphoræ compositi ... ...
Linimenti sinapis compositi ... ... āā ℥j.
Olei pini sylvestris... ... ...

Misce, fiat linimentum. To be rubbed in twice a day, and the joint packed with cotton-wool

When there are decided signs of effusion, the following combination may be applied, spread freely on long strips of lint, and maintained in contact with the joint by a close-fitting flannel bandage :—

℞ Linimenti hydrargyri ... ... } āā ℥j.
Linimenti potassii iodidi cum sapone ... }
Misce, fiat linimentum.

Niemeyer states that he has found a *powerful hot douche* one of the most efficient of revulsives, causing a hyperæmia of the skin lasting several hours. Vapour douches are also used in bathing establishments for this purpose.

When there is much pain in the joint, anodyne applications must be applied for its relief. Of these there are many. Equal parts of chloroform and belladonna, or of chloroform and opium liniments, are as good, perhaps, as any. After a hot douche, either of these may be applied on lint (saturated) and the joint enveloped in cotton-wool. Equal parts of veratrine ointment and chloroform liniment rubbed up together make a suitable application. Liniments containing menthol and aconite are also used.

The external application of *sulphur* is said by some authorities to have a special virtue in the relief of chronic rheumatism. The sublimated sulphur is rubbed in over the surface of the joint and adjacent skin, and some of it is also sprinkled over a layer of absorbent cotton-wool, which is then applied round the joint and fixed by a thin flannel bandage. At the same time, in order to obtain the full effect of the sulphur medication, a small teaspoonful of confection of sulphur may be taken night and morning or a sulphur tabloid three times a day immediately after food. This treatment should be persevered in for two or three months at a time. *Ichthyol* lanoline ointment (50 per cent.) has been found of value in the relief of chronic rheumatism ; after washing with hot soap and water this ointment is well rubbed twice daily into the affected joint, which is then wrapped up in cotton-wool. Ichthyol contains sulphur, and is thought by some to act in the same way, and, like sulphur, it is also prescribed internally in capsules in these cases (5 to 10 grains). A somewhat weaker ointment (30 per cent.) has been found to relieve the swollen and inflamed joints in subacute cases. There is no doubt that the friction and passive movements used in applying many of these remedies contribute greatly to the good results obtained. Stockman recommends the injection with a hypodermic needle of 5-10 minims of 1 per cent. aqueous solution of chromic acid into the small fibrous indurations that are so commonly present. He finds that it leads to shrinking and disappearance of the nodule.

Next as to the value of **electricity:** some consider it of not much use in the treatment of chronic articular rheumatism; others, however, set great store by it, especially when combined with other treatment. Its use has been found to be attended by a subsidence of the pain, and a disappearance of the periarticular thickening and exudation, as well as by an improvement in the nutrition of the wasted muscles. Jacoby* recommends "strong currents to be passed through the affected joint in all directions by means of a large well-moistened electrode. *Labile galvanic* and *faradic* application should be made to the surrounding tissues." The galvano-*faradic* current he thinks best for treatment of the surrounding muscular atrophy. He agrees that the treatment of such cases must be very protracted, but that "we can accomplish more by the aid of electricity than without such help."

Massage *and systematic* **movements** of the affected joints play, perhaps (together with hot baths), the most important and efficient *rôle* in the cure of chronic rheumatism. Special attention must be devoted to the removal of any local indurations. Quite remarkable results are obtained by the long and patient employment of these methods, especially when combined with hot baths and douches; the swelling of the joint is reduced, ankylosis prevented, muscular atrophy checked, and often free movement of the limb restored. At first massage must be light and general, but later deep kneading movements must be concentrated on the areas specially affected. To be of full and permanent value massage will often require to be maintained for several months.

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* Electrotherapy, in Cohen's "System of Physiological Therapeutics," vol. ii.

The prolonged and systematic employment of **hot baths** has long been one of the most popular and universally recognised methods of treatment of chronic rheumatism, and since it has become the custom to combine with the use of the bath the application of massage and passive movements, even better results have been obtained.

The thermal springs chiefly resorted to for the cure of chronic rheumatism are the *indifferent* thermal baths, such as Bath, Buxton, Wildbad, Gastein, Ragatz, Schlangenbad, and Plombières; or the hot *sulphur* baths, such as Aix-les-Bains, Aix-la-Chapelle, Baden in Switzerland, Harrogate, and Strathpeffer (where the springs are heated artificially); or the hot salt and brine baths such as Droitwich (water artificially heated), Nauheim, Bourbonne-les-Bains, Wiesbaden, Baden-Baden, and many others; or the pine baths and various kinds of mud baths, such as are obtained at Homburg, Marienbad, Dax, Saint Amand, Néris, Bormio, and elsewhere (at Strathpeffer peat baths are used). Seeing how various is the composition of the hot mineral springs that have attained an equally great reputation for the cure of chronic rheumatism, there can be little doubt that the chief curative agents are the high temperature of the bath, the prolonged immersion, and the skilful and judicious combination of douches, massage, passive movements, and electricity which the physicians at these various stations employ.

The Scotch douche, that is, alternate streams of hot and cold water rapidly and briefly applied, has been found most serviceable in many cases of chronic articular rheumatism. Very hot baths are rarely now used, unless in exceptional cases. The best temperature is one ranging between 95° and 102° F. About thirty consecutive baths are usually given in average cases, and then a rest is desirable, and after a few months, in obstinate cases, the course may be resumed. The duration of the bath, the temperature of which should be maintained uniform, is usually about half an hour, but towards the end of the course many bath physicians increase the duration of the bath even to an hour. Turkish or Russian vapour baths are not found so serviceable in this malady as warm-water baths. After a bath the patient should be wrapped in a flannel dressing gown, and allowed to rest on a reclining-couch for half an hour or an hour.

Drinking the water at these thermal baths is quite a secondary matter. In some spas, as at Gastein, there is practically no mineral water drunk ; at others, the bath physicians think drinking useful, either to keep up the action of the skin started by the bath, or for the eliminative and cleansing effect of the free consumption of water. Some believe that by drinking the water, especially the salt and the alkaline-saline waters, change of tissue and the absorption of exudations are promoted and the general nutrition improved.

Hydrotherapy, unless limited almost exclusively to the application of hot or warm water, is not suited to old chronic cases, but in recent cases a careful and cautious application of hydrotherapy may prove very useful, as by hardening and improving the tone of the skin the sensitiveness of the surface to external impressions of cold and damp may be greatly diminished. For the same reason it is often advantageous, after a cure at a thermal spa, for the patients to pass a few weeks in a dry, bracing, sub-alpine resort, or at the seaside, where a daily spray-bath, of moderately cold water, followed by brisk friction, may prove restorative of muscular and nervous tone and vigour.

The only counter-indications of thermal treatment are advanced age, and the presence of renal or arterial degeneration, or considerable circulatory disturbances.

In recent years methods have been devised, and largely adopted, of applying super-heated air locally in this and other painful affections of the joints, and they have also been treated by submitting them to both the *light* and *heat* developed in the *electric* arc. In many cases great relief has been experienced, but it has not always been permanent. In the *Tallerman* method the heat is obtained from gas, and the limb, suitably covered, is exposed to a high temperature in a sort of gas oven.

In the *Dowsing* method for the employment of *luminous radiant* heat the heat is *radiated* from specially constructed incandescent electric lamps and reflected on to the part to be treated ; a temperature up to 500° F. can thus be obtained.

In the *Greville* system, which has been widely adopted, the thermal electric rays only are used.

2. **Internal medication** has a very limited application in the treatment of simple chronic articular rheumatism. Salicin and the salicylates have little influence over these cases. They may be of use when a chronically inflamed joint becomes hot, tender, and painful ; but in the typical chronic form of articular rheumatism we are now considering, they are of little avail. No possible harm can, however, arise from trying them for a few days. Brandis of Aachen advocates the use of sodium salicylate, in very large doses, while taking a course of the sulphur waters, but we are by no means convinced that this practice is sound. When the urine is dense, high-coloured, and strongly acid, and deposits lithates abundantly, alkalies should certainly be given until the urine is restored to a normal condition.

Constipation also, if it exists, must be overcome, and elimination generally promoted. Potassium or sodium iodide often proves a very serviceable remedy, especially in those cases where elimination is defective : it should be given in 5- or 10-grain doses three times a day in combination with potassium bicarbonate and aromatic spirits of ammonia, the latter to counteract the depressing effect of the iodide. Small doses of colchicum, added to an aperient pill, in constipated cases, and taken nightly, are often attended with benefit.

Guaiacum and *sarsaparilla* are remedies which have been greatly praised in the treatment of chronic rheumatism, and guaiacum will, in some cases, act with remarkable effect, especially in relieving the nocturnal pains, if a full dose be taken at bed-time. It acts best, however, in cases of chronic *muscular* rheumatism; yet it has the drawback of quickly losing its remedial effect.

Guttmann has advocated *salipyrin* (a combination of salicylic acid and antipyrin) in the treatment of rheumatism. He states that it rapidly removes the pain and swelling of the joints. The dose is 15 grains, which he gives in cachets every two hours. *Aspirin* has been very favourably reported on by many physicians in this and in gouty joint affections. It does not disorder the stomach as some salicylates do, nor cause circulatory depression. We have found it useful in 15-grain doses (in cachets) at bed-time.

We have already alluded to the internal use of sulphur and ichthyol. In young people iron or arsenical tonics with cod-liver oil are useful in improving the resisting power and tone of the constitution, but this form of joint affection is not common in young subjects; they are more prone to the attacks of so-called "rheumatoid arthritis," which we shall presently consider.

The difficulty experienced by some in distinguishing between chronic articular rheumatism and chronic gouty arthritis, and the fact that gouty and rheumatic affections certainly appear together, not unfrequently, in the same person, has no doubt contributed to the very varying estimates formed by different observers of the value of different medicines in this disease. For the relief of these complex cases a more complex medication will be needed; and when a case of chronic rheumatism is over-lapped, as it were, by gouty manifestations, internal remedies directed to the relief of the latter will also be needed.

3. Lastly, the **hygienic** and **regiminal** treatment of chronic rheumatism has to be considered. The food of such patients should be light, nutritious, and readily digested. The digestive peculiarities of individual patients must be observed, and as nutritious a diet prescribed as is consistent with the maintenance of normal digestion. Whatever food tends to cause assimilative difficulties, a good test of which is the occurrence of deposits of lithates in the urine, should be prohibited. Fresh tender meat, poultry, game, and fish, in strict moderation; fresh vegetables, stewed celery, Spanish onions, lettuce, watercresses, broccoli, and ripe cooked fruits; rice, tapioca, and other farinaceous foods; butter, cream, milk; all these are admissible, provided that there is no digestive peculiarity which might cause any of them to disagree. A purely vegetarian diet has been found suitable by some patients. Fermented alcoholic drinks are best wholly avoided. Home-made lemonade and plenty of pure water are the best beverages. Avoidance of exposure to cold and damp, and thoroughly warm clothing and a warm bed should be insisted on. Too much clothing, however, is harmful, by producing an over-sensitiveness of the skin and confining the perspiration; but porous woollen garments, which, while keeping the surface of the body warm, allow of free cutaneous transpiration, should be recommended.

Rheumatic persons should inhabit dry, warm dwelling-houses, built on a dry subsoil, and protected from inclement winds. As a general rule the seaside should be avoided. When their means permit, it is desirable that they should pass the winter in the south, in resorts which have a warm, dry, and equable climate.

CHRONIC MUSCULAR RHEUMATISM (MYALGIA)

Myalgia has been termed a "pseudo-rheumatic" affection, because some authorities doubt its *rheumatic* nature,and are more disposed to regard it as a neuralgia of the sensory nerves of the muscles. What is certain is that it often occurs in persons subject to chronic articular rheumatism, and that it can constantly be traced to the same etiological factors—viz. exposure to cold and wet, and especially to exposure after fatigue. And rheumatic myalgias require much the same treatment as the analogous joint affections. Persons who inherit the rheumatic or gouty constitution are well known to be especially prone to such attacks. The chief symptom is **pain,** usually limited to a certain particular set of muscles, although in some cases it will be more generalised. The pain is rarely accompanied by fever, and varies very much in intensity and duration. It is often excited or aggravated by particular movements, and it is relieved by *firm* pressure. It may disappear in a few days, or it may continue, with varying severity, for some weeks, and it is very prone to recurrence. One of the most painful and remarkable of these affections is that known as **lumbago.** It is remarkable because of the often extreme *suddenness* of its onset, and the occasional severity of the pain. A person is stooping to pick up some object on the ground, or to open a drawer, or is making some slight effort of a like kind, when he is suddenly seized with a severe pain in the muscles of the loins, which may completely incapacitate him for some days, and make it impossible for him even to turn over, or to lift himself in bed. This form is most commonly observed in men at or after middle age. Another form, met with most frequently in young people, is an affection of the muscles of one side of the neck, and termed **torticollis,** or *stiff neck*, as the head is held constantly to one side, in a fixed position; or the muscles on one side of the chest may be affected—the pectoralis major, the serratus magnus, and the intercostals—causing the respiratory or other movements of the chest to be painful. This is termed **pleurodynia.** Muscular groups in other localities may be similarly affected.

The **treatment** of these forms of rheumatism, *when chronic*, is determined by much the same principles as those which apply to chronic articular rheumatism; but attacks of myalgia frequently follow a much more acute course, and we therefore look to obtaining a more immediate result from treatment. In these acute forms the treatment should be both *local* and general.

It is needless to say that the painful muscles must be **rested.** Repose in bed is an important element in promoting a rapid cure. In pleurodynia this rest may be made more complete by controlling the thoracic respiratory movements on the affected side, by applying two or three broad strips of adhesive plaster firmly round the chest. *Dry heat* is a very efficacious remedy, and in cases of lumbago is best applied by covering the loins with a layer of flannel and passing a hot flat iron over it; or a large mustard plaster may be applied; or brisk friction with turpentine liniment, and then a thick layer of cotton-wool made as hot as possible, applied, and fixed with a flannel bandage, is an excellent remedy. Dry-cupping is advocated by some physicians. Other measures suited to an acute attack are hot baths or fomentations, followed by a dry hot pack; or a hot *vapour* or Turkish bath, with shampooing of the painful muscles. If the pain is strictly localised and limited, the application of the mixed belladonna and chloroform liniments (equal parts) often affords immediate relief. It should be applied on lint saturated with it, and over this a layer of oil silk should be placed, then some cotton-wool, and finally a flannel bandage. Applied in this manner it will be found to act as a powerful revulsive as well as anodyne. Fagge found the local application of methyl-chloride on lint remarkably efficient in relieving a severe case of lumbago. *Anti-*

phlogistine, a proprietary preparation, said to consist of fine anhydrous pulverised clay, with which are incorporated pure glycerine, compounds of iodine, boric and salicylic acids, and the oils of peppermint, gaultheria, and eucalyptus, is a soothing and often very effective application. It is spread on the part hot and thick, and covered with a layer of cotton-wool and a bandage.

Internal treatment is also useful in these acute cases, and if they are seen at the very onset, diaphoretics answer remarkably well, along with the administration of a brisk purgative. One of the best is a draught composed of 20 grains of salicin (or sodium salicylate), 12 grains of Dover's powder, a dram of spirits of nitrous ether, half an ounce of solution of ammonium acetate, made up to two ounces with camphor water. This taken at bed-time will usually produce profuse perspiration and complete relief of the pain. The patient should, however, be kept in bed the whole of the next day at least, and he should take salicin or sodium salicylate twice daily for a week or more. There can be no doubt of the great value of the salicylates in these cases. Should the urine be loaded with lithates, some alkali, such as 30 grains of potassium citrate, or 20 grains of potassium bicarbonate, should be given with each dose of the salicylate. The salicylate of cinchonidine has been warmly praised by some American practitioners. It is given in capsules or in tabloids in doses of 2 to 5 grains three or four times a day. Another salicylate which has been much prescribed in America, both in acute and chronic rheumatism, is *methyl salicylate* (the artificial *oil* of wintergreen). Internally, it is given in doses of 10 to 15 minims, either in capsules or made into an emulsion; externally, a dram or two poured on a double layer of aseptic gauze is applied to the part affected, and left on for several hours. Ammonium chloride is a favourite remedy with some practitioners, but we have not found it *very* efficacious. Antipyrin and phenacetin are both useful for relief of pain, but when it is very intense it may be necessary to give a hypodermic injection of morphine ($\frac{1}{4}$ gr.) and atropine ($\frac{1}{60}$ gr.).

Sir James Grant * has found *acupuncture* a very efficacious method of relieving certain forms of myalgia, as lumbago and pleurodynia. He uses fine steel needles (No. 8), a variable number according to the extent of the painful parts, and inserts them from $\frac{1}{2}$ to $\frac{3}{4}$ inch through the skin into the muscular tissue, from 1 inch to 2 or 3 inches apart. They are removed after a minute or two. The painful muscles, hard and tense before puncture, rapidly relax after puncture and the pain disappears. Sir James makes the interesting suggestion, which he illustrates by well-known experiments, that the needles set free an abnormal storage of electricity accumulated in the affected muscles. More probably we have to do with a serous effusion beneath the deep fascia. It is then easy to understand why acupuncture gives relief, which may be carried still further by a succession of hot fomentations. After the acute stage is passed, local massage and mild derivative measures by skin and bowel will fulfil this indication for treatment.

In chronic and less acute cases other remedies may be needed. Various local measures have been advocated. Blisters, the application of the constant current, Paquelin's cautery, stroking and kneading the painful muscles, a course of thermal baths, in lingering cases—each of these measures has in its turn been found very useful. It is desirable in these chronic cases to seek for any constitutional or diathetic indication for treatment. In distinctly gouty cases colchicum, potassium iodide, sodium salicylate, and alkaline-aperient waters, together with a carefully restricted diet, may prove curative. In the more purely rheumatic cases guaiacum and sulphur are valuable remedies. In anæmic and asthenic forms we may get excellent results from full doses of iron, arsenic, or quinine combined with strychnine or nux vomica. As preventive measures, warm clothing, the avoidance of over-exertion and fatigue, and removal from a damp and cold locality to a dry and warm one, obviously suggest themselves.

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* "Abnormal Electrical Storage in the Human System," by Sir James Grant, M.D., F.R.C.P., Consulting Physician, General Hospital, Ottawa.

ARTHRITIS DEFORMANS—RHEUMATOID ARTHRITIS—OSTEO-ARTHRITIS

This is a constitutional disease of chronic type, characterised by wide-spread changes in the joints, involving more or less all the joint tissues, together with pronounced atrophy of the muscles and great deformity. Long regarded as a gouty or rheumatic affection, and termed "rheumatic gout," the disease has little or nothing in common with either rheumatism or gout. In the early stages of the disease the most prominent feature in the joints is a periarthritis, involving the synovial membrane, ligaments and capsule; thickening of the synovial membrane, as a rule, contributes more to the enlargement of the joint than does effusion. Later, changes in the cartilage and bone as well tend to become manifest. Proliferation of the cells of the cartilage and fibrillation of the matrix lead to its gradual disintegration and erosion; the ends of the bones, no longer separated by intervening fibro-cartilage, become smooth, dense, and eburnated. At the margins of the joint portions of cartilage and bone, escaping erosion, give evidence of the proliferative process in "lipping" of the cartilage and formation of bony "osteophytes," which contribute further to the fixity and deformity of the joints. These changes in the cartilage and bones led to the use of the name "osteo-arthritis." It is commonly held that these changes represent only a more advanced form of the disease known as "rheumatoid arthritis." Some, however, maintain that the two processes are essentially distinct, and cannot be referred to one and the same cause, acting with greater intensity, or over a longer period of time.

Various types of the disease have been described. There is the *arthritis deformans* of children, described by Still, in which the peculiar features are notable enlargement of the lymphatic glands with some increase in size of the spleen ; the joint changes tend to be confined to the soft tissues. There is an *acute progressive type*, affecting many joints simultaneously, attended with a certain amount of fever, and apt to be mistaken for subacute rheumatism, and a *chronic progressive type*, which is the form far more often encountered. The symptoms of this form consist of pain and swelling affecting certain joints symmetrically and attacking usually those of the hands first, then the knees and feet, and finally, in extreme cases, nearly all the joints of the body. The pain may be but slight, or it may be very great, especially at night. It is nearly always aggravated by cold easterly or northerly winds, and often also by damp. Crepitation or grating can usually be felt on grasping the joints and moving them. In advanced cases considerable muscular atrophy supervenes, and contracture and fixation of joints leads to extreme deformity and helplessness. Profuse sweating or a constant clammy moisture of the body surface, especially of the palms of the hands, is a frequent feature, so too is a patchy brownish pigmentation of the skin. During the active stages of the disease there is always some disturbance of general health, and often severe anæmia. In some fortunate cases, after two or three joints have been attacked, the disease becomes arrested ; and in the majority the disease reaches a quiescent stage, in which, although there may be much crippling and deformity, there is at least freedom from pain and the general health remains fairly good.

Another form of the disease is recognised under the name of *Heberden's nodes*. In this small hard nodules appear at the sides of the distal phalanges of the fingers ; there is usually some affection of the adjacent joints. In such cases the larger joints are very rarely affected.

Lastly, there is the *monarticular* type, seen most characteristically in morbus coxæ senilis. This is a disease of later life, affecting chiefly males, and so frequently a sequel of traumatism as to raise some doubt of its identity with osteo-arthritis. It is usually confined to a single large joint, which undergoes complete destruction; "osteo-arthritic" lesions, so called, are often a marked feature of the process.

The causation and pathology of this disease are obscure. Of late years many observations have been made pointing to an *infectious* origin, though no one of the organisms isolated has yet established its claim to be regarded as the specific cause. Cases of multiple arthritis with all the clinical characters of rheumatoid arthritis are met with in connection with ulceration of the colon. Pyorrhea alveolaris has at times exhibited a distinct causal relation, and with its removal the articular trouble has at once subsided. The clinical features of the disease, the febrile disturbance, rapid pulse, and sweating, the wide-spread affection of many joints, the enlargement of lymphatic glands and spleen, all confirm the view that the disease has an infectious origin. If this be so, we may reasonably assume that the organisms flourishing in the joints produce toxines, which enter the general circulation and produce the familiar vaso-motor and trophic disturbances. It is remarkably more common in women than in men, but except for its frequent association with the menopause, no special relation has been traced to sexual disease or disorder. Prolonged anxiety, shock, traumatism, a life of hard work and over-exertion, exposure to cold and damp (as depressing agents) have all been invoked as etiological factors, and it is important, from a therapeutic point of view, to note the apparent dependence of the disease on low, depressed states of health and defective nutrition, as well as on local irritation from over-exertion of certain joints.

Though one of the most intractable diseases we have to deal with, when firmly established, there is no doubt that, if recognised at the outset, and treated thoroughly and continuously with the loyal co-operation of the patient, the disease may be completely arrested, leaving so little trace of its previous existence as to justify the term "cure." We venture to lay stress, therefore, on the importance of early diagnosis. Once the disease has become chronic, the best we can hope is to arrest its further progress and restore fuller mobility to the affected joints. Whatever course of treatment we adopt must be maintained for a long period of time, and it is well to impress on the sufferer from the outset the necessity for patience and persistence.

The chief indications for treatment are—1. To search for a possible source of infection, and if found, to remove it. 2. To remove all depressing influences, and to maintain strength and nutrition at the highest level possible. 3. To neutralise the toxines produced and to promote their elimination. 4. To get rid of deformities and contractures of joints and to prevent their recurrence. 5. To relieve symptoms, of which pain is the most frequent, as they arise.

1. When a case of rheumatoid arthritis is presented for treatment, we should at once search for a primary source of infection—as, for example, in the nose, ear, mouth, and alimentary canal, in the genital and urinary passages, or in the presence of suppurative lesions elsewhere. Chronic ulceration of the large intestine is one of the most frequent associations. Pyorrhea alveolaris and extensive dental caries may each call for attention. Only too often, however, the search discloses no apparent focus. If any such is discovered, it must be dealt with as circumstances determine.

2. Bearing in mind the frequency with which depressing agents seem to induce the disease, we must see to the remedy of all influences of this nature. In

maintaining the strength and nutrition of the patient *dietetic* and *hygienic* treatment is of much importance. The diet should be as generous and varied as is consistent with the avoidance of dyspeptic troubles. Animal food and fat should be freely partaken of, and a certain amount of sound wine or beer may be permitted, unless there is a tendency to acute exacerbations of the joint affections, when it will be best to avoid alcoholic drinks altogether. When possible, exercise in the open air should be encouraged—riding, driving, or walking, as is best suited to the individual case. If the patient is confined to bed the room should be kept fresh and airy, remembering always that these patients are very susceptible to chill, as the skin is prone to free perspiration. For this reason clothing of light, warm, absorbent material should be worn next the skin. Patients should avoid exposing themselves to cold winds and damp, and should live in warm dry houses built on sand or gravel. Climate is of immense value, and if a patient can, at the very onset of the malady, be removed at the appropriate season to a warm, dry, equable climate, it affords a good chance of cure. Egypt and Algiers present the requisite features of climate in the fullest degree.

The use of *tonics* responds also to this indication for treatment, and of these *arsenic* is of special value in chronic cases. It is well to give it in combination with iron: $\frac{1}{24}$ to $\frac{1}{12}$ grain of sodium arsenate with a dram of syrup of the iodide of iron, or with 10 grains of the citrate of iron and ammonia in an ounce of water, may be given after each meal thrice daily. *Cod-liver oil* is of great service also. It should be given in small doses at first, and gradually increased till the patient is taking two or three tablespoonfuls daily: if preferred, it may be combined with malt extract. Quinine is very useful in febrile cases, and, combined with belladonna and strychnine, is serviceable in checking the tendency to perspiration. The following is a good combination:

℞ Quininæ sulphatis	gr. xlviij.
Strychninæ sulphatis	gr. $\frac{1}{2}$.
Extracti belladonnæ	gr. iv.
Syrupi quantum sufficiat.	

Misce, fiat massa in pilulæ quattuor et viginti dividenda. One, three times a day.

We have attempted in cases of rheumatoid arthritis to improve general well-being by the use of the *high-frequency current*, but are unable to speak favourably of its effect. Indeed, we have seen it produce a state of distressing nervous irritability, with diffuse neuralgic pains.

3. In the belief that the disease is of infectious origin, and that the infecting organisms elaborate toxines that are carried into the general circulation, *antitoxic* remedies have come into general use and are specially indicated during the acuter phases. Luff claims that *guaiacol carbonate*, if given early, in sufficient doses and over a long period of time, is capable of arresting the disease, diminishing the size of the joints and increasing their mobility, and of relieving pain. He considers that it acts as an antiseptic to the source of infection in the intestine, and, after absorption, to the toxines in circulation. He gives 5-10 grains in cachet, three times a day, and gradually increases each dose to 15-20 grains. Another convenient form of administration is the Parke, Davis and Co. 5-grain compressed tablet. At the same time Luff usually gives a mixture of iodide of potassium with tincture of nux vomica and compound syrup of glycero-phosphates, in chloroform or peppermint water. He gives the iodide in full doses, starting with 10 grains three times a day. We must be careful not to give iodide to patients who show marked susceptibility to its depressing influence. We ourselves prefer to give the iodide of iron, a teaspoonful of the syrup in water three times a day after meals. Salol, benzozol, and various salicylates have all been recommended for their antiseptic property, but cannot be

said to exert any marked influence. Salicylates and aspirin are, however, often of much service in the relief of pain, particularly during an acute attack. Recently antistreptococcic serum has been used, but without success : nor would it be reasonable to expect such in the absence of clear proof of a streptococcic origin. Ichthyol is another drug which has gained some favour : it may perhaps exert an antiseptic sulphide action in the bowel. Milk rendered sour by lactic acid bacilli has recently been advocated as a cure for this disease, as for so many others, but our own experience has not disposed us to attach great value to it as a method of treatment.

If we are unable to antagonise directly the toxines, still we can promote their ready *elimination*. Warm clothing and warm climate, to each of which we have already alluded, subserve this purpose. General massage too, by its influence on the circulation, will promote this end. Hot-air baths have long been used for this purpose, and for the relief they afford in some cases to the pain in and about the joints. The electric light cabinet, in which we get the combined action of light and heat, is perhaps the best. The entire body may be exposed, at a temperature of about 170° F., so as to excite free general diaphoresis. At first, it is well to allow the bath only every second or third day.

The value of warm mineral baths has long been established in the treatment of this disease. It must not be presumed that *all* cases will benefit from this treatment, and in any given case it is difficult to say beforehand whether a good effect is to be expected. It is by no means unusual to meet with cases that have been made distinctly worse at thermal baths, when the treatment has not been carefully adjusted to the patient's state of health. In selecting a bath we should be guided by the desire to find, at the same time, a warm, dry, sunny, and agreeable residence, where the patient could be much in the open air and in the sunshine. The warmth of Aix-les-Bains is one of its great advantages in the treatment of these cases; and Ragatz, in Switzerland, has many claims to consideration. Wildbad and Baden-Baden are pleasant places, with excellent bathing arrangements, but they are not so warm and dry as the preceding. Bath and Buxton in England are suitable, but both places leave much to be desired in regard to climatic conditions. Treatment at Strathpeffer and Woodhall Spa has been found serviceable in some cases. It is difficult to say how warm mineral water baths produce their effect, but something at least must be set down to the improvement of circulation and the increased action of the skin, aiding elimination, over and above the local influence on the joints.

Peat-baths, such as may be had at Strathpeffer and Harrogate, are another pleasant method of applying moist heat to the general body surface.

4. The measures suitable for treatment of the joints will be necessarily very different in the acute and in the chronic stages of the disease. In the acute attack, even if the patient be not confined to bed, pain and swelling will necessitate complete rest of the affected joints. This may be rendered more effective by wrapping the inflamed joints in cotton-wool. If there is much pain, hot fomentations sprinkled with laudanum may be applied to the joints. Another useful anodyne consists of equal parts of camphor, chloral, and menthol painted on the joints; so is methyl salicylate diluted with an equal quantity of olive oil, and with the addition of a dram of menthol to each ounce of the combination. Whatever local applications are employed, they should be relaxed as soon as freedom from pain permits, so that the patient may be encouraged to commence movements of the joints at the earliest possible moment. Local treatment in the acute stage will receive much assistance from the simultaneous internal administration of aspirin, or sodium salicylate, with the addition of antipyrin, if called for. After the acute attack is over, and the disease passes into a chronic state,

active treatment of the joints for the prevention and correction of deformities must be vigorously prosecuted. The patient should be instructed to manipulate the joints and move them to the fullest extent. *Massage* of the joints and muscles is then of great value; by causing more blood to flow through the part it not only stimulates nutrition of muscles, but also of nerves, and so reduces pain and spasm. At the same time it promotes the absorption of inflammatory exudate around the joint. Massage should be light, and all tender areas should be carefully avoided.

Gentle friction of the joints with some mildly stimulating liniment, together with gentle passive movements, applied twice daily, will be often found as useful a local measure as any. After bathing the joints with hot water, the following liniment may be used :—

℞ Olei pini sylvestris... ... ...} āā ℥ss.
Tincturæ iodi ... ...}
Linimenti saponis ... ... ad ℥iv.
Misce, fiat linimentum.

When there is fluid effusion in the joints, the application of hot compresses soaked in a saturated solution of common salt will sometimes aid disappearance of the fluid. We have found benefit from the application of *iodine* paint, *not* directly over the affected joint, but between the affected digital joints and an inch or two above and below the large joints of the limbs.

Counter-irritation along each side of the spine has been used, and is said to relieve pain and inflammation of the joints; for the upper limb, we shall blister at the level of the cervical enlargement of the cord, and for the lower limb at the level of the lumbar. Direct counter-irritation of the joints by blistering or by the actual cautery is a procedure of needless severity, and one that is likely to interfere with the very necessary attempts at active or passive movements of the joints.

Douche massage, i.e. a combination of massage with douching of the joints, is of much value in the earlier stages of the chronic process. Douche massage may often be usefully employed, along with Bier's method of *passive congestion.* Bier's method aims at producing venous engorgement of the joint, by means of a broad elastic bandage wound round the limb above the joint with sufficient tightness to impede the venous circulation. The object of this treatment is to encourage the existing hyperæmia, in the belief that it represents a healthy effort on the part of the body to antagonise the invading organisms. Some remarkable results have been obtained by the judicious employment of this method.

Hot-air baths are also used as an adjunct to massage and movements of the joints. In some cases they certainly help to restore mobility to the part, by relaxing spasm and by stimulating the local circulation.

Electricity, either in the form of the continuous or interrupted current, is of little value in the treatment of the joints. It should never be employed in acute cases, or when pain is great. Erb, speaking from a very wide experience, considers that he has occasionally improved the general nutrition as well as the local trouble. He applies the continuous current to the spinal cord for from ten to fifteen minutes at a sitting, to the cervical region when the upper extremities, and to the lumbar region when the lower extremities are chiefly affected; and a continuation of the treatment for *several months* is advocated! In our opinion electrical treatment cannot compare with massage in its effects on the nutrition of the muscles, and thereby on the mobility of the joints.

Extension, by means of weights and pulley, will sometimes be the only means of dealing with extreme contracture and fixation of a joint. The knee will sometimes be found flexed in this way, almost to a right angle, from allowing the patient to remain in bed in this position without any effort to prevent the deformity.

ADDITIONAL FORMULÆ

Mixture for rheumatism

℞ Potassii iodidi, ʒij.
Sodii salicylatis, ʒj.
Syrupi simplicis, ℥j.
Aquæ menthæ piperitæ ad ℥vj.

M. f. mist. A tablespoonful twice or thrice daily.
(*Dujardin-Beaumetz.*)

Mixture for chronic rheumatism

℞ Sodii iodidi, ʒij.
Sodii bicarbonatis, ʒiv.
Potassii bicarbonatis, ℥j.
Liquoris arsenicalis, ʒjss.
Decocti sarsæ compositæ ad ℥xx.

M. f. mist. A small tablespoonful in a claret-glassful of effervescing potash water three times a day after meals.
(*Whitla.*)

Mixture for chronic rheumatism

℞ Pulveris guaiaci resinæ, ʒj.
Potassii iodidi, ʒj.
Tincturæ colchici seminum, ʒiij.
Syrupi, ℥ij.
Aquæ cinnamomi ad ℥vj.

M. f. mist. A dessertspoonful to a tablespoonful twice daily. (*Philadelphia Hospitals.*)

Anti-rheumatic mixture

℞ Sodii salicylatis, ʒiij.
Aquæ laurocerasi, ℥j.
Spiritus vini rectificati, ℥ss.
Syrupi simplicis, ℥j.
Aquæ ad ℥vj.

M. f. mist. A tablespoonful twice to five times daily.
(*Dujardin-Beaumetz.*)

Pills for chronic rheumatism

℞ Acidi arseniosi, gr. jss.
Pulveris guaiaci, ʒjss.
Pulveris capsici, gr. xv.
Pilulæ aloes et asafœtidæ, ʒjss.

M. et divide in pil. lx. One three times a day.
(*Fothergill.*)

Confection for chronic rheumatism

℞ Pulveris guaiaci resinæ, ʒiij.
Pulveris rhei, ʒij.
Potassii tartratis acidæ, ʒv.
Sulphuris sublimati, ʒx.
Pulveris myristicæ, ʒj.
Mellis, q.s.

Ut f. confectio. About half a small teaspoonful night and morning. (*Fernandez.*)

(This contains the same ingredients as the so-called "Chelsea Pensioner." *See* Note, p. 489, *post.*)

Anti-rheumatic syrup

Take of

Sarsaparilla, cut and bruised, 2 oz.
Guaiacum chips, 2 oz.
Water, 4 pints.
Boil down to 16 oz., and add 32 oz. of sugar.

Next, take of

Extract of opium, 10 grains.
Resin of guaiacum, 4 drams.
Carbonate of potash, 3 drms.
Tinct. of colchicum, 2½ drms.
Essence of lemon, 2 drops.

Rub these together, and add little by little to above syrup when cold, and strain. Half a teaspoonful or a teaspoonful for a dose. (*Dubois.*)

Liniment for muscular rheumatism

℞ Chloroformi }
Olei olivæ } āā ℥j.

M. f. linim. To be rubbed over the painful regions. (*Bamberger.*)

Liniment for chronic rheumatism

℞ Liquoris ammoniæ }
Olei terebinthinæ } āā ℥ss.
Olei olivæ, ℥j.
Olei limonis, ʒss.

M. f. linim. (*Copland.*)

Another

℞ Olei cajuputis }
Tincturæ opii } āā ʒij.
Olei terebinthinæ, ℥ss.
Linimenti ammoniæ, ℥j.

M. f. linim. (*Fuller.*)

Liniment for chronic rheumatism

℞ Tincturæ aconiti, ʒij.
Olei terebinthinæ, ℥j ad ℥ij.
Tincturæ opii, ℥j.
Linimenti saponis ad ℥vj.

M. f. linim. To be used three times a day. (*Hare.*)

Ointment for chronic rheumatism

℞ Veratrinæ, ʒj.
Hydrargyri protiodidi, ʒj.
Unguenti petrolei, ℥j.

M. f. ung. To be applied over the joints. (*Hare.*)

CHAPTER II

TREATMENT OF GOUT

Phenomena of an Attack of Acute Gout—Relation of Uratic Deposits to Articular Gout—"Tophi"—Other Gouty Lesions—Cardio-Vascular and Renal Changes—Neuralgic and Cutaneous Affections—Blood State in Gout—How are the Phenomena of Irregular Gout produced?—"Uric Acid does not cover the whole Field of Gout"—Sir William Roberts's Observations—Criticism—Relation of "Purin" Bodies to Gout—Etiology of Gout—Gout a Disorder of Retrograde Metabolism—*Indications for Treatment*—Value of Colchicum—Of Salicylates—Of Guaiacum—Of Potassium Iodide—Of Alkalies—Clinical testimony to their efficacy—Lithium Salts and Piperazine—Magnesium Salts—Mineral Waters in Gout—Vichy, Carlsbad—Sodium Chloride Springs—Lime Springs—Indifferent Thermal and Sulphur Springs—Value of Water as an Eliminant and Solvent—Usefulness of Hot Baths—*Treatment of an Attack of Acute Gout*—General and Local—Treatment of Chronic Forms—Pistoja Powders—*Dietetic and Regiminal* Treatment—Diet should be as free from Purins as possible—Exercise—Climate. Additional Formulæ.

Gout has been defined as "a disorder of nutrition with disturbed nitrogen metabolism and an excess of uric acid in the blood, usually accompanied by arthritis, which is characterised by the deposition of sodium biurate in the periarticular cartilages and tissues."

In order to be able to discuss, with advantage, the treatment of gout, we must first consider, as briefly, however, as possible, its chief clinical manifestations and, so far as at present understood, its pathological nature. But notwithstanding a vast amount of experimental research undertaken with the view of throwing light on the pathology of gout, it must be admitted that it still remains involved in much obscurity.

The clinical characters of an attack of **acute gout** are the following:—Its onset is sudden, often in the night, and its seat is usually the ball of the great toe, or it may attack the ankle, heel, or instep. The part attacked, at first, feels somewhat hot and painful, and the pain increases quickly in severity until it becomes intense and almost unbearable; the tenderness is also exquisite, and the patient cannot endure even the contact of the bed-clothes. Soon there is some fever with shivering and chilliness, and the temperature may rise to 102° or 103°. The pain after a few hours often remits and is less severe. The veins around the painful joint first appear swollen, and shortly the whole joint becomes swollen, tense, shining, and of a deep red colour. The subcutaneous tissues are œdematous, and pit on pressure. For the next few days there are usually evening exacerbations and morning remissions, and it is not uncommon for the other foot to be attacked in precisely the same manner. The duration of the attack is variable; it may be over in a few days, or it may be composed of a series of minor and irregular paroxysms, which may incapacitate the patient for many weeks. The skin desquamates as the swelling subsides.

An attack of acute gout is commonly preceded by some troubles of digestion—acidity, flatulence, loss of appetite, constipation, and scanty, high-coloured urine. After the attack the patient not unfrequently feels much better than he has done for some time. The attacks are prone to occur at irregular intervals, their frequency often being determined by the mode of life of the patient; but in some instances, whatever care he may take, the attacks return with increasing rapidity, and finally he is left with joints permanently crippled, deformed and disabled by gouty infiltrations and deposits.

It must, however, be remembered that, now adays gout does not appear so frequently in this acute form, and the joint affection is often slow in developing, and a good deal of minor uneasiness in the part may be for some time complained of, before the characteristic acute swelling, redness, and tenderness appear.

Although the great-toe joint is usually the first to be attacked, other joints generally suffer, especially the smaller ones, the digital joints, and the ankles and wrists.

It is believed that these joint affections are dependent on the precipitation and deposit of sodium biurate crystals in the cartilages, ligaments, synovial membranes, bursæ, and other structures forming part of, or in proximity to, the articulation. In some of the most distressing forms of *chronic* gout, the joints of the fingers, and less frequently those of the toes, become surrounded by massive deposits of sodium biurate (tophi) which sometimes slowly ulcerate through the skin; we have seen masses as large as horse-beans thus discharged. Such patients are often by this means rendered absolutely helpless, and cannot even feed or dress themselves. Small deposits of urate of soda are also often observed on the margins of the ears, and occasionally on the inside of the eyelids, on the arches of the palate and elsewhere.

All *gouty* persons do not, however, suffer from such decided manifestations of *articular* gout. They may occasionally have twinges of pain in the joints, and a hot condition of the hands and feet, and perhaps a little thickening around some of the digital articulations; but they are apt to suffer from other disturbances of health, dependent apparently upon blood states similar to those which, in other persons, give rise to attacks of articular gout. The most serious of these are the *cardio-vascular* and *renal* changes that are determined by the gouty state. The blood tension is persistently high, the vascular walls become thickened, and cardiac and renal changes gradually develop. The existence of a gouty phlebitis is generally recognised. Headaches, especially migraine, and neuralgias of various nerves, including visceral nerves, not unfrequently arise. Certain skin affections, especially eczema, are also prone to appear in such persons; and many inflammatory disorders of the various mucous membranes are believed to be dependent upon or aggravated by gouty irritation.*

The blood in chronic gout always contains an excess of uric acid, and Sir William Roberts stated that uric acid in the blood "passes into solution in the first instance as a quadriurate," and he inferred that "in the *normal* state uric acid is primarily taken up in the system as quadriurate," and is finally voided in the urine as quadriurate; and in health its elimination is sufficiently active and complete to avoid its detention or accumulation in excess in the blood. His hypothesis was that "in the gouty state this tranquil process is interrupted, either from defective action of the kidneys, or from excessive introduction of urates into the circulation, and the *quadriurate lingers unduly in the blood and accumulates therein.* The detained quadriurate circulating in a medium which is rich in sodium carbonate gradually takes up an additional atom of base and is thereby transformed into *biurate*"—a less soluble and less easily excreted compound. At present most physiological chemists maintain that there is no such uric acid compound as the quadriurate of Roberts, and that it is impossible for it to exist in a medium such as that of the circulating blood. Garrod taught that in gout the alkalinity of the blood is lessened, and he attributed the deposition of the urate of soda to the diminished alkalinity of the plasma; but it is now stated that the alkalinity of the blood in gout is either normal or increased.

How uric acid in the blood produces its injurious effects, whether by *mechanical* injury due to the precipitation of crystals of sodium biurate in the tissues, or by circulating in the blood in solution as a

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* The late Sir George Paget, when taking part in a discussion on the Therapeutics of the Uric-acid Diathesis, which the author opened at the meeting of the British Medical Association in Dublin in 1887, pointing to a long list of morbid conditions the author had drawn up as dependent on or associated with gout, said in support of the reality of the connection, "I think I may say I have had all of them!"

true poison, Roberts thought easy of explanation so far as *regular* articular gout was concerned. "The crystalline urates precipitated in the cartilaginous and fibrous structures of the joints necessarily act as foreign bodies; they excite irritation, clog the lymph channels, exercise pressure on the tissue elements, and impede their nutritive operations," hence the inflammation, pain, swelling, and subsequent degenerative changes in the joints.

But it is difficult to accept this *mechanical* theory as explaining the phenomena of *irregular* gout. "The visceral disturbances and manifold neuroses which trouble the gouty have not yet been anatomically traced to uratic precipitation." Sir William Roberts saw equal difficulty in adopting the toxic view. He argued that there was no proof that uric acid is poisonous. "The system of the gouty man is at times surcharged with uric acid. On the eve of an outbreak the fluids of his body—in parts, at least—must be impregnated with biurates to saturation; for, of course, no precipitation can occur until this point is reached. Yet, with fluids thus saturated with urates, such persons betray not the slightest sign of poisoning, and enjoy complete immunity from symptoms of every kind until overtaken unwarned by the sudden precipitation which provokes the arthritic attack." But this statement, although applicable to some of those who suffer from attacks of typical acute gout, does not apply to the sufferers from irregular gout. The individual who is prone to attacks of acute arthritic gout rarely, it is true, suffers from the *irregular* non-arthritic form, because, we take it, his other tissues are but slightly sensitive to the gouty poison; whereas the sufferers from *irregular* gout possess tissues peculiarly sensitive to it, which react to the poison and resent its presence long before it has accumulated in sufficient quantity to be deposited in the joints, or probably to assume a crystalline form. In answer to Sir William Roberts's other argument that "manifestations of irregular gout are so extremely diverse in seat and character that it is hard to believe that they can be produced by one and the same toxic agent," we would point to the familiar and analogous phenomena which attend the toxic action of certain drugs, in persons hypersensitive to their action. The smallest dose of quinine will produce an erythematous rash in one, a headache in another, and gastric discomfort in a third. Alcohol will poison one man's motor centres, leaving his intellect scarcely touched, while in another it will obscure his intelligence and leave his motor centres comparatively unaffected. Many other illustrations of this nature might be advanced, so we think this objection is not a valid one. With another opinion of this author we are more entirely in accord—viz. that uric acid does not "cover the whole field of gout," and that "if uric acid were altogether eliminated a pathological entity would still remain and be recognisable as gout."

Professor Bouchard has expressed the same opinion. He says: "It has by no means been demonstrated that in gout uric acid is the only or even the chief matter contaminating the fluids . . . many of the chronic lesions of gout are in part composed of or occasioned by precipitated urates; but the disease itself is not due to uricæmia."*

If we accept Sir William Roberts's argument that the phenomena of irregular gout may be due to precipitation of crystalline urates in the tissues, this view would dispose of the assumption that uric acid and its compounds are *toxic*, and would refer their morbid influence solely to their "sparing solubility in the bodily media," and their consequent proneness to precipitation in the crystalline form.

If this view of the nature and causation of the morbid phenomena of irregular gout be accurate and sufficiently comprehensive, the chief therapeutic indication, when such phenomena were actually present, would be to endeavour to increase the solvent power of the blood and the fluids of the body for crystalline sodium biurate, so that it might be eliminated. But there is good reason to doubt whether the therapeutic indications of the gouty state are so simple as this. Sir William Roberts showed conclusively that many of the substances given as remedies for gout, in the belief that they promote the holding in solution and thereby prevent the deposition or even favour the re-solution of sodium biurate, could not so act, and he inferred that they could not be remedies for gout. This inference, however, covers far more ground than the premisses from which it is deduced. Sir William Roberts subsequently admitted that uric acid "does not cover the whole field of gout," and the error, we imagine, lies not in the conclusion that none of these substances are remedies for gout, but in the explanation which has been advanced of their mode of action.

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* "Maladies par Ralentissement de la Nutrition" (2nd edition), p. 261. *See* also the author's address to the Balneological and Climatological Society on "Hepatic Inadequacy and its Relation to Irregular Gout," *Brit. Med. Journal*, June 15th, 1201.

The sodium salts, for instance, which he especially repudiated, may exert their remedial influence by a beneficial action on the gastric, intestinal and hepatic functions, or on the nutritive changes in the tissues, quite irrespectively of any direct solvent action on sodium biurate. By their action on the liver they may prevent "the excessive introduction of urates into the circulation," or by their stimulating action on the kidneys they may counteract the tendency to their "unduly lingering in the blood and accumulating therein," so that their influence may be in the truest and best sense *remedial*, inasmuch as they would attack the morbid processes nearer their origin and source.

The tendency of recent research has been to lessen the importance of the *rôle* played by uric acid in the etiology of gout and to direct attention to the relation of the "**purin**" bodies to this disease.

Some observers, as Chalmers Watson and Woods

Hutchinson, on the other hand, regard the symptoms of gout as due to bacterial infection, and look upon this disease as an intestinal auto-intoxication.

"The 'purin' bodies include all those constructed on the base C_5N_4. Some twelve different combinations of this kind are known to exist in nature, while a large number have been produced in the laboratory. Those of ordinary occurrence are uric acid, caffein, theobromine, xanthein, hypo-xanthein, guainin and adenin. These are found in meat and meat extracts, and especially in glandular organs, such as the pancreas and liver; they occur in smaller amount in many vegetables and in certain other articles of diet."*

These purin bodies, which are considered to have so important a relation to the pathology of gout, are derived from the "nucleins," which compose the cell nuclei. The breaking up of these nuclei gives rise to uric acid and other purin bodies. These bodies, then, may be either "*endogenous*," *i.e.* derived from the nuclei of the living body itself, chiefly from muscle metabolism, or they may be "*exogenous*," *i.e.* derived from "food-nuclei," from animal and vegetable matter taken in as food. So that the phenomena of gout may depend either on a perverted metabolism of the body cells—a disturbance of the metabolism of the endogenous purins—or on an excessive supply of purin bodies in the food consumed. It has been observed that by feeding men and dogs with nuclein a marked increase occurs in the output of uric acid.

It has also been discovered that certain tissue ferments play a most important *rôle* in the metabolism of purin bodies, and that while some "enzymes" found in the body appear to be responsible for the production of uric acid in the body, others have the power of destroying uric acid and converting it into urea and other substances. The failure of the enzyme to effect this transformation may, for instance, be caused by the inhibitory action of alcohol, and this action, combined with food rich in purins, results in an excess of uric acid in the blood, and consequently in the urine, so that a diet rich in proteids, together with alcohol, would certainly predispose to the development of gout.

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* "Notes on Purin-Free Diets," by Dr. W. A. Potts, *Lancet*, October 6th, 1906.

According to these new views gout is regarded as a disturbance of purin metabolism, or a "perversion of the general metabolism of the tissues."

It is believed, then, as we have said, that uric acid plays only a secondary part in the causation of gout, and is "a mere weapon" of the disease; that its excess in the blood is probably due to diminished oxidation in the system; that somewhere in the body a ferment is produced which, normally, is necessary for the proper destruction or oxidation of uric acid, and that owing to some organ or organs failing to produce this ferment, proper oxidation of uric acid does not occur, and it consequently accumulates in the blood. It is certain that an excess of uric acid in the blood cannot alone be regarded as the cause of the deposition of sodium biurate in the tissues, for in leukæmia there is a notable increase of uric acid in the blood, yet it is not usual to find biurate depositions in the tissues.

The modern tendency is, then, to believe that "ferments" play an important part in the formation and destruction of uric acid in the blood. It is suggested that it is formed partly by oxidative processes from the nucleins, and partly by synthetic formation in the liver. Although it is maintained that the symptoms of gout are not directly traceable to the action of uric acid, yet it is admitted on the evidence of pathological anatomy that its salts play a considerable part in causing the characteristic lesion of the disease. But the excess of uric acid in the blood, and the deposition of sodium biurate in the tissues, are secondary manifestations, and rather the result than the cause of the disease.

The therapeutic indications that have been formulated, in agreement with these views, are that we should endeavour to influence favourably *purin* metabolism, so as to reduce the excess of uric acid in the blood by (1) lessening its formation; (2) augmenting its elimination; (3) promoting and hastening oxidation in the body; and (4) increasing its solubility in the blood and tissues.

We have unavoidably gone beyond our usual limits in our examination of the modern views of the pathological nature of the gouty manifestations; we must now enumerate briefly its known etiological factors, and then proceed to consider its therapeutics.

The hereditary character of gout; its tendency to appear in the male much more frequently than in the female; its preference for adult age, though occasionally met with in childhood; its proneness to attack persons who live too freely, and who consume food and stimulants, especially wine and malt liquors, in great quantity; its association with chronic acid dyspepsia; its peculiar prevalence in climates such as that of the British Isles, cold, humid and changeable; its occasional determination by depressing emotions and intellectual strain, and its singular connection with lead intoxication—all these, its chief etiological relations, are well known.

We believe the best guide to the treatment of gout is the acceptance of the fact that it is mainly a **disorder of elimination,** and especially of hepatic elimination—a defect or feebleness in the function or functions of elimination of the waste products of nutrition. This defect may be inherited, and then it appears occasionally in a very intractable form. It may be acquired, and is then more readily ameliorated and controlled.

We have ventured elsewhere to speak of gout as "disturbed *retrograde* metabolism." It can scarcely be a disorder of *constructive* metabolism, for it rarely occurs during growth and development, and in many of those who are prone to its visitations constructive metabolism is remarkably vigorous, active, and apparently normal. Its comparatively rare occurrence in women, who produce much less nitrogenous waste than men, owing to their less active lives, and who have an additional outlet for waste products in the menstrual flux, further corroborates this view. There is reason, then, for concluding that in the gouty the constructive metabolism may be normal, but the **destructive metabolism**, the processes for the removal of waste, are prone to morbid disturbance, and that *inadequacy of the hepatic functions* is at the root of many of the irregular forms of gout.

The **general indications** in the **treatment of gout**, then, are, first, to promote *elimination* of waste; and secondly, to prevent *accumulation* of waste. In the management of the *acute* arthritic attacks we have the additional indication to allay local pain and inflammation, and in the chronic joint affections to endeavour to restore the normal mobility of the joints.

We must take a larger view of "the whole field of gout" than that covered by the uric-acid theory, and must set ourselves free from any domination by *a priori* considerations deduced from experiments outside the human organism.

The appeal to practical therapeutic results is the best test of the probability of any theory put forward in explanation of the phenomena of gout.

It will be convenient, in the first place, to discuss the value of certain of the remedies proposed for the treatment of gout, and subsequently to refer to certain details in the management of the acute attack and of other manifestations.

We will commence with **colchicum.** This remedy was at one time much discredited, and it had, no doubt, in former times been misused. When attacks of acute arthritic gout were far more common than they now are, *over-doses* of colchicum were no doubt often given, and evil results naturally followed. But most of those who have had the largest opportunities of forming an opinion of the value of colchicum in gouty affections are advocates of its use.*

Its most constant action is, we believe, on the hepatic secretion. Again and again, when the motions have been pale and clay-coloured from the absence of bile, we have seen a few doses of colchicum restore the natural dark colour due to a proper admixture of that secretion. It seems to act sometimes as a diuretic, and sometimes as a diaphoretic, and when it acts more especially on the skin the renal secretion may appear to be diminished by it, and naturally, also, when it causes watery alvine evacuations.

Graves thought, and Lecorché supports the view, that it prevents or checks the formation of uric acid in the system, and this it may do by its decided action on the liver. Our own view is that it acts more or less on all the excretory organs; that it is a stimulant to excretion; and as we regard the gouty constitution as one whose fault is especially a sluggish and imperfect retrograde metabolism, and delayed excretion generally, not necessarily of uric acid alone, colchicum is in a special sense its remedy by promoting the elimination of waste products.

The prejudice against colchicum has induced Ebstein to make the extraordinary statement that it is preferable to relieve the pain of the gouty paroxysm by hypodermic injections of morphine. He says they act "quicker, more easily, and with less danger." No doubt they act *quickly!* But the internal use of opiates in gout we consider, save in exceptional circumstances, undesirable. In a disease of defective elimination ought we to give a drug which depresses in a remarkable manner the function of all the excretory organs but the skin?

Colchicum, then, we maintain, is one of the most valuable remedies, when judiciously given, for many of the morbid manifestations of gout, and, so far from being always a dangerous vascular depressant, we have shown, in our hospital practice, that in a case of chronic gout with subacute exacerbations moderate doses of colchicum restored regularity and strength to an irregular and feeble pulse, and this, no doubt, it did by promoting the elimination of substances which were depressing the cardiac tone,

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* Graves, Watson, Garrod, Luff, and many others.

Much difference of opinion exists as to the value of the **salicylates** in gout. Sodium salicylate is certainly of value in some chronic affections of joints allied to gout. Its action as a hepatic stimulant makes it serviceable in some forms of irregular gout. It also relieves nearly all forms of articular pain. We are not, therefore, disposed to set it aside, as some authorities do, as without value in gout. We must also remember that its use, in certain forms of gout, has been commended by such skilled practitioners as Professor G. Sée, Bouchard, Dujardin-Beaumetz, Lecorché, Whitla, and others. Lecorché found it very useful in the treatment of gouty asthma, angina pectoris, and cystitis. Bouchard thinks it a dangerous drug in cases of cardiac degeneration or cases in which the kidneys are involved. Futcher believes that the salicylates increase the total output of nitrogen and augment materially the excretion of uric acid.

We regard it as a useful alternative remedy in acute and febrile attacks of gout with high pulse tension in patients whose kidneys are sound, and in chronic forms which prove intractable to other remedies it should be given a trial.

High commendation was given by Garrod to the use of **guaiacum** in chronic articular gout. "I could relate," he says, "many hundreds of cases in which guaiacum has proved especially valuable; in some its action is almost magical. I have now for twenty years or more employed guaiacum very extensively in the treatment of chronic gout—I believe, in some thousands of cases—and there is no remedy of which I can speak so confidently." We have certainly found this drug give great relief to the chronic articular and muscular pains of persons who were undoubtedly subjects of gout.* Dr. Luff also bears testimony to its value "as an alterative which stimulates the metabolism of the liver, and also affords relief to the portal system." † It is very useful as a prophylactic. For this purpose it may be given in 5- to 10-grain doses in cachets after food thrice daily. Or the guaiacum mixture of the B.P. may be given, in doses of an ounce, night and morning.

For chronic gout a widely adopted remedy is **iodide of potassium.** Its use in arthritic affections is widespread, but it has its most important applications, we believe, in the less easily recognised degenerative changes dependent on this diathesis. We allude especially to the renal and vascular changes. Iodide of potassium, or sodium, if long continued in moderate doses, has a remarkable influence in retarding the progress of those degenerative vascular changes dependent on the gouty constitution,

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* In the copy of a letter, dated October 23rd, 1813, in the possession of the author, reference is made to "a lately-discovered medicine for the cure of the gout—a very valuable discovery of a medicine of great efficacy; the secret had been brought from America by a British soldier many years ago. It had been given with almost unfailing success to vast numbers of his fellow-pensioners at Chelsea Hospital, and its fame had become so general that the medicine was called 'The Chelsea Pensioner.' Lord A., in consequence, applied for it and received the utmost benefit, but the person who possessed the secret did not at first attend to any proposal for divulging the mode of preparing the medicine; but at length he has accepted £500 and an annuity of £200, and has given up the secret, which I now enclose to you. Manner of making the medicine for the gout or rheumatism called 'The Chelsea Pensioner':—

Guaiacum Powder	1 dram.
Rhubarb	¼ ounce.
Cream of Tartar	1 ounce.
Flower of Sulphur	2 ounces.
Clarified Honey	1 pound.

A Nutmeg, powdered fine.

"Mix the above ingredients well together and stir the mixture well every time before taking a dose. The dose is two large teaspoonfuls at night and morning; and continue thus taking it till the whole is taken. If it operate in a very active way, the morning dose may be sometimes omitted."

† *Practitioner*, July, 1903.

when in the early stage, which, if left untreated, sometimes advance with great rapidity.

In cases with slight albuminuria and commencing vascular changes we have found iodide of potassium or sodium (the latter is less depressing), in doses of 5 grains thrice daily, continued for a few weeks, and repeated from time to time, of remarkable value in improving the general condition; and we have not unfrequently seen the albumen disappear from the urine, or be reduced to a mere trace. How the iodide acts in these cases we are not prepared to say; but it promotes the action of certain of the excretory glands, and sometimes acts as a powerful diuretic. Its influence in promoting the elimination of deposits in the tissues is established by its power of removing lead and mercury from the system in cases of chronic intoxication by these metals. It is necessary to "feel one's way" with regard to dose, some constitutions requiring a much larger one than others. We repeat that iodide of potassium is a valuable remedy, not only in the chronic and sub acute arthritic affections of this diathesis, but also in the graver but less *obvious* arterial and renal changes when not too far advanced.

The value of **alkalies** in the treatment of gout has been almost universally accepted. But Sir William Roberts* challenged the validity of that opinion, and we must therefore examine this subject fully. "Clinical experience," he said, "on the use of alkalies speaks with a doubtful voice"; and the hypothesis that by "increasing the alkalescence of the blood they enhance its solvent power on the material of gouty deposits and thereby delay or prevent their formation," he considered the evidence of his experiments "entirely destroyed." "It has," he said, "been conclusively proved that alkalescence, as such, has no influence whatever on the solubility of sodium biurate."

We must, then, either give up the use of alkalies

* Croonian Lectures.

in gout, which we are not disposed to do, or we must find some other explanation of their mode of action, or we must be content to administer them as we do colchicum, without knowing precisely how they act.

But let us see what is the testimony of clinical physicians on this matter. Professor J. Stewart says: " Alkalies are of value in relieving not only the arthritic symptoms present in an acute gouty attack, but they also tend to remove or lessen the amount of uric acid in the blood."* Dujardin-Beaumetz, commenting on the utility of alkaline waters, observed that " they do not act by neutralising an excess of uric acid, but by acting on the *general nutrition*, the functions of which they regulate."† " Alkalies," testifies Professor Whitla, " by forming soluble salts with uric acid, which salts, acting as diuretics, are freely washed out in the urine, cause marked elimination of uric acid, and are the most valuable of gouty remedies."‡ Professor Bouchard points out that " the alkalies are indispensable to certain acts of disassimilation [what we have termed retrograde metabolism]; without alkaline bases the organic acids could not be consumed in the economy," and their utility in gout he would refer to their influence in quickening nutritive changes.§ " Alkalies," Fagge observes, " are decidedly useful in gout."|| Lecorché maintains that " the bicarbonates and the sulphates [he prefers the sodium salts] are *par excellence* the medicines for the gouty diathesis,"¶ and he bases his conclusion upon the influence they exert over the metabolism of nitrogenous substances. " Alkaline waters," says Professor Dieulafoy,** "are of incontestable efficacy." Niemeyer, while expressing a strong

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. i., p. 662.

† "Clinique Thérapeutique," vol. iii., p. 512.

‡ "Dictionary of Treatment," p. 306.

§ "Maladies par Ralentissement de la Nutrition."

|| "Practice of Medicine," vol. ii., p. 681.

¶ "Traité de la Goutte," p. 554.

** "Pathologie Interne," tome iii., p. 505.

conviction of the value of alkaline waters in gout, is careful to state that his belief is not based on the supposition that they act in any special manner on *uric acid.*[*]

Sir Thomas Watson, without reference to any theory of uric acid elimination, and supporting a recommendation of Sir H. Halford, advises as a prophylactic remedy that *every day* 15 grains of potassium bicarbonate should be taken with tincture of rhubarb and some light bitter.[†]

With this mass of evidence before us, which we could largely increase, we cannot accept the conclusion that "clinical experience on the use of alkalies" in gout "speaks with a doubtful voice." Their remedial influence in gout may largely depend on their remedial effects on related morbid disturbances of the gastric and hepatic functions. It is worthy of note that the majority of French authors, who have not fallen so much under the influence of Garrod's teaching, and who have regarded the value of alkalies in gout as depending rather on their general influence on metabolism than on their special solvent influence on uric acid, have mostly advocated the use of the sodium salts, while those who have been dominated by the idea of exerting a solvent action on uric acid have preferred salts of potassium and lithium.

It is further worthy of note that, in spite of all the theoretical denunciations of the use of sodium salts in gout, the gouty, from all quarters of the globe, have resorted, and continue to resort, in steadily increasing numbers, to those Continental springs in which the salts of sodium are overwhelmingly predominant.

As an instance of the confusion that exists in the minds of some of the most eminent authorities on this matter, we would quote an observation on the treatment of gout from a well-known text-book: "Potash water, Apollinaris or seltzer water should be taken freely. Waters with the sodium salts should be avoided." Now the chief mineral constituents of both Apollinaris and seltzer waters are *sodium* salts!

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[*] "Practice of Medicine," vol. ii., p. 504.

[†] "Principles and Practice of Medicine," vol. ii., p. 773.

As to the superiority of lithium salts in gout as promoters of the solubility of sodium biurate, and as tending to prevent the formation of uratic deposits, Sir William Roberts's conclusions were that they had not the slightest effect of this kind; and the same with regard to the much-lauded "piperazine." "If these bodies," he says, "have any beneficial action in gout, it is certainly not due, as has been supposed, to their solvent action on the material of gouty concretions."*

The value of lithium salts in the treatment of gout has been greatly over-estimated. Although the equivalent of lithium is low, and the necessary dose is small, most of its preparations are far less soluble than those of potash and soda, and we fail to see any decided advantage in being able to give 4 grains of lithium carbonate instead of 8 grains of potassium bicarbonate; and even Garrod does not claim so large a relative superiority as this for the lithium salts. The diuretic effect of potassium bicarbonate is more constant and reliable, especially when given with hot water containing a little milk, which quite conceals its taste. If we select a mineral water for the treatment of gout, solely and specially because it contains, say, a tenth of a grain of lithium chloride in a pint, our practice can hardly be said to be *rational*.

Of the depressing effect on the heart of large doses of salts of lithium we have seen many examples, and we have reason to know that the popular and indiscriminate use of lithium preparations, now so common, has exercised a seriously injurious effect on many persons.

Ebstein maintains that lithium chloride has no solvent action on uric acid, and that if a mineral water contains the carbonate, in very minute quantities, it becomes wholly converted into chloride in the stomach, and is therefore, as far as the lithium salt is concerned, quite without efficacy.

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* Croonian Lectures.

The superiority of the sodium compounds in dyspeptic states, in gastric and intestinal catarrhs, and in disturbance of the functions of the liver, so common in the subjects of this diathesis, was admitted by Garrod himself. Dr. Luff, following the teaching of Sir Wm. Roberts, observes that "a patient suffering from gout should avoid the excessive use of common salt at table owing to the power it possesses of diminishing the solubility of sodium biurate, and thereby hastening the precipitation of that body"—but he also admits that "the use of sodium salts is certainly beneficial in some gouty conditions—in cases of sluggish action of the liver, of gastro-intestinal catarrh and torpor, of gouty dyspepsia, and of other forms of irregular gout. Mineral waters containing sodium salts are undoubtedly beneficial owing to the action of those salts as hepatic and gastro-intestinal stimulants." *

It has been suggested that we have been to blame in allowing the compounds of lime and magnesia to fall into disuse in the treatment of the gouty constitution. Salts of magnesia are found in many of the mineral springs which enjoy a reputation in the treatment of this diathesis, and many gouty patients have testified to the great benefit they have found in frequently taking a dose of Gregory's powder.

The old-fashioned "white mixture" so frequently prescribed for gouty patients is, as is well known, a combination of sulphate and carbonate of magnesia.

Closely connected with the use of alkalies in gout is the employment of **mineral waters.**

There is one thing which strikes one forcibly in approaching this subject, and it is that nearly every kind of mineral water that exists has been recommended in the treatment of the gouty constitution—the carbonate of soda waters of Vichy, the chloride of sodium springs of Homburg, the sulphate of soda waters of Carlsbad, the lime waters of Contrexéville and Bath, the sulphur waters of Harrogate and Aix, the indifferent thermal waters of Buxton and Gastein, and even the iron waters of St. Moritz; while there are a vast number of other springs, like those of Royat, which base their claim to be considered as remedies for gout upon the salts of lithium they contain.

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* *Practitioner*, July, 1903.

If each of these springs, so different in composition, is of value in the treatment of gout, we should naturally look for certain conditions common to them all. These are:—1. The quantity of water, more or less pure, taken into the body under regulated conditions daily. 2. The altered mode of life, the regular exercise in the open air, the modified diet, the early hours, the absence of business cares. 3. In many foreign spas there is the drier and hotter Continental climate. 4. The stimulating effect to excretion and "tissue change" which the baths, douches, frictions, massage and electricity applied at most of them induce.

These are conditions, and not unimportant ones, common to most mineral-water cures; and in the "indifferent thermal" springs which are chiefly applied to the relief of the chronic joint affections, deposits, deformities, and loss of muscular power dependent on gouty inflammations, the thermality and modes of application of these hot springs are probably the chief operative agents.

We can only here refer very briefly to the chief of these resorts.*

1. Vichy may be taken as the type of purely alkaline waters, its chief and all-important constituent being sodium bicarbonate (Vals, Ems, Neuenahr, Apollinaris are of the same character).

Durand Fardel, after more than forty years' experience at Vichy, satisfied himself that its springs "are extremely efficacious in gout." In gout, he says, the water should only be employed in the intervals between the attacks. He considers its good effects to be attributable to the influence of the soda in promoting a normal and regular nutritive metabolism. He denies that it exercises any debilitating influence, as was asserted by Trousseau, unless it is improperly and injudiciously employed.

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* Full details will be found in the author's work on the "Therapeutics of Mineral Springs and Climates."

The cases best suited to Vichy are gouty dyspeptics, fairly vigorous, with a tendency to pass acid urine, with deposits of urates and uric acid, or with temporary attacks of glycosuria.

2. Carlsbad is one of the special resorts of the gouty. Its waters are hot, but of varying temperature, and contain considerable quantities of sodium sulphate, sodium bicarbonate, and sodium chloride. It is a common error to regard these waters as very "lowering" purgative springs. They are aperient, but when properly administered only gently so, and it is often found necessary at Carlsbad to add a teaspoonful of the Carlsbad salts to the first glass of the water to ensure an action of the bowels. These springs have a remarkable action on the liver, and they have been especially utilised in the treatment of the gouty constitution when this is associated with hepatic congestion, hæmorrhoids, and "abdominal plethora." Dr. Kraus asserts that he has found its waters "indicated in all cases of gout," and their use "attended with the most remarkable results." He specifies, however, those cases in which vascular and renal degenerations have set in, as well as the weak and debilitated, as requiring very careful supervision. We should not ourselves advise any regular mineral course in such cases ; it is exceedingly undesirable to surcharge with water, even for a short time, the vascular system when it is the subject of degenerative changes. Dr. Kraus states that *recent* gouty deposits "will generally disappear during or soon after the use of the Carlsbad waters, but that they have no influence over chronic indurations." We regard the Carlsbad course, when accompanied (as it is) with the employment of the hot mineral or mud baths, as exceedingly valu-

able in promoting elimination by all the chief excretory organs of the body, skin, kidneys, and intestines, for in this way it stimulates normal nutritive metabolism and promotes the discharge of the waste products of imperfect metamorphosis. Treatment at Carlsbad is counter-indicated in the feeble subjects of *atonic* gout.

3. There are a large and important group of springs in which the chlorides (especially the chloride of sodium) are the chief ingredients. Leamington in England, Homburg and Kissingen on the Continent, may be taken as examples of cold springs of this class; Nauheim and Wiesbaden of hot ones. The hot springs of this class are generally admitted to be valuable in chronic rheumatic conditions, but there is some hesitation in admitting their utility in gouty states. In the treatment of gouty articular deposits, Ebstein and others estimate highly the hot springs of Wiesbaden, applied as baths, and also drunk hot. Ebstein quotes the experiments of Pfeiffer to show that the water of Wiesbaden greatly increases the renal excretion and the quantity of urea excreted.

Homburg and Kissingen are especially applicable to chronic dyspepsias, to gastric catarrhs in gouty persons, whose gout, however, does not assume a very serious aspect. The waters are diuretic and slightly aperient; they are considered to "promote tissue change," to promote elimination also, to check the tendency to obesity, and to "ward off" the more serious gouty affections.

4. The most difficult waters to comprehend are those earthy waters containing chiefly sulphate and carbonate of lime, like those of Contrexéville and Vittel. We have visited personally most of the important spas of Europe, and have remarked that the springs at nearly all of them are administered in moderate and sometimes in quite small quantities by the physicians who practise there. But it is quite otherwise at Contrexéville; there the glasses hold

each about twelve ounces, and as many as eighteen glasses a day are occasionally ordered by the physicians, and over-zealous patients will occasionally add half-a-dozen more on their own account!

One of the objects of passing this large quantity of fluid through the urinary passages is, no doubt, to mechanically dislodge and carry away calculous deposits lodged in the kidneys; and, indeed, the success which frequently attends these efforts is remarkable. But is it possible that this water exercises any solvent effect on the surface of these calculi, or on uratic deposits in the system? We were assured by the able physicians in practice there that in gouty persons large quantities of uric acid are excreted during, and sometimes for a long time after, the course.

Another interesting point about the use of these sulphate of lime waters is the decidedly purging effect they often exercise at Contrexéville. This is at once apparent by the abundant provision made for such a consequence. Is this the result of the mere overflow and passage through the intestines of undigested water, as is maintained by practitioners at rival springs? Or is it that this large quantity of water conveyed (when taken, as it is, in the morning fasting) immediately through the hepatic portal circulation stimulates a free secretion of an abundance of thin, very fluid bile, which acts as a quick purge when it reaches the intestine? Or is it that both these events happen? Several patients who were trustworthy observers assured us that their evacuations were distinctly "bilious," and not merely "watery."

5. The local treatment of gouty deposits, of gouty deformities, and gouty myalgia and neuralgia, often attended with marked advantage at such thermal springs as Buxton, Gastein, Wildbad, Bath, and Aix, owes much of its success, no doubt, to the thermality of those springs, and especially to the frictions, douches, massage and electrical appliances there employed. And in the case of the indifferent springs,

the ingestion of a certain amount of warm water daily acts, no doubt, as a useful solvent and eliminant.

It has recently been suggested that the *radio-activity* manifested by these springs *at their source* may have some important influence in determining their therapeutic effects, and that this may account for the circumstance that an artificially prepared water, having precisely the same electrical composition as a natural mineral water, fails to produce the same curative effects as the natural spring when this is drunk, or otherwise employed, as it emerges from the earth.

6. The sulphur springs, as those of Aix, Harrogate, and Strathpeffer, find their appropriate application in those numerous instances of the gouty constitution which are accompanied with cutaneous eruptions, as psoriasis and eczema, and also in those subacute or chronic cases where we desire to promote the absorption of gouty deposits from the joints and tissues.

But one of the advantages to be derived from a course of mineral waters is, as we have already suggested, the quantity of that most important eliminative agent, **water,** that is ingested, and it is not necessary to resort to a mineral spring in order to consume an adequate quantity of this valuable solvent. No remedy is more valuable and important in the treatment of the gouty diathesis than the regular consumption of a considerable quantity of pure water, and preferably **hot water.**

As a diluent and solvent of renal excrementitious substances it is most useful, while in its rapid passage through the system it must dissolve and carry away waste matters from the blood and tissues. When drunk at a higher temperature than that of the blood the effect of this hot water flowing through the hepatic portal circulation is to stimulate the functions of the liver cells and promote biliary excretion. It thus responds fully to the foremost indication in the treatment of gout—*i.e.* "to promote the elimination of waste," while, by temporarily diluting the blood, it must tend both to favour the solution of uratic deposits and to prevent their precipitation.

The subjects of this diathesis would do well to drink daily a teacupful of hot water on first rising in the morning, another half-an-hour before dinner, and a third the last thing at night, as a preventive measure.

In combining the regular application of hot baths of some duration (fifteen to thirty minutes) with the ingestion of hot water, as is the practice at most thermal stations, a powerful appeal is made to another *eliminating* organ, viz. the *skin;* and a further step is taken in carrying out the indication for evacuant treatment.

In short, all the measures that have been found by experience to be of value in the treatment of gout are directed to promote and hasten "retrograde metabolism."

The preceding considerations have chiefly had reference to the remedial treatment of the constitutional state in the gouty, and of the more chronic manifestations of this disease; we must now consider briefly the treatment of an attack of **acute articular gout,** such as we have described at the commencement of this chapter. We have said that the gouty subject often feels better after an acute attack of regular articular gout than he may have done for some time previously, and an acute outbreak of gout in the great toe has occasionally been contemplated with a certain amount of satisfaction. "A gouty man, tormented with symptoms of irregular gout, is relieved by a regular arthritic attack. . . . This arises from the complete, or approximately complete, precipitation of the urates floating in his blood and lymph into the structures of the joints. The urates are thereby almost as effectually removed from the vital fluids as if they were eliminated by the kidneys" (*Sir W. Roberts*).

If the foregoing view of the nature of the articular attack be correct, ought we to interfere actively in treating such an attack? If our idea, in treating such an attack, be to redissolve the precipitated urates, and so restore them to the circulation, we should, unless we could at the same time ensure their elimination by the kidneys, apparently be rendering our patient a doubtful service. No doubt we ought to pursue mainly an eliminative treatment, and to aid the organism as well as we can to throw off peccant substances in the blood that have led to the acute joint attack, and so we may prevent an excessive injury to the articular structures originally attacked, or obviate the involvement of more joints. For this reason we should avoid, if possible, the internal use of opiates, because of their tendency to check elimination. We must, however, especially have regard to the constitutional state of the patient, for treatment that would be most appropriate in a plethoric, robust subject might be wholly unsuited to a feeble, debilitated person, worn out, perhaps, by repeated acute attacks, or suffering at the same time from arterial and renal changes.

In a robust patient, with an uncomplicated attack of acute articular gout, we should administer moderate doses of colchicum in combination with an alkaline saline aperient. The following formula is a good one for the purpose :—

℞ Magnesii sulphatis...	℥jss.
Magnesiae levis	ʒij.
Potassii citratis	ʒiv.
Tincturae seminum colchici	ʒij.
Aquae carui... ... ... ad	℥viij.

Misce, fiat mistura. Two tablespoonfuls with two of hot water every three hours until the bowels have been freely relieved. This, we must repeat, is for strong, robust patients only.

After the bowels have been freely acted upon, the sulphate of magnesia should be omitted, and when the joint pain is to a great extent relieved the mixture should be given every six, instead of every three, hours; it will, however, be found useful to continue to give a dose of the original mixture every morning, to maintain an aperient effect so long as the acute attack lasts.

If there should appear to be any reason for avoiding the use of colchicum, or should there be any counter-indication to the employment of aperients, such as the co existence of an intestinal flux, we may use the following mixture of salicylate :—

℞ Sodii salicylatis	ʒij.
Potassii citratis	ʒiv.
Tincturæ zingiberis	♏xxx.
Aquæ cinnamomi	ad ℥viij.

Misce, fiat mistura. Two tablespoonfuls every two or three hours until the pain is relieved, then every five or six hours.

If desirable, a pill, containing a moderate dose of colchicum, together with some aperient, may also be given at night, as well as the above mixture ; as, for instance, the following :—

℞ Extracti colchici	gr. iij.
Pilulæ colocynthidis et hyoscyami ...	gr. xx.

M. et divide in pil. vj. One at night.

The best local treatment for the relief of the pain is to pack the joint with a warm alkaline and opium lotion. A lotion, containing half an ounce of carbonate of soda in crystals and 2 drachms of laudanum, to 10 ounces of water, should be prescribed. A portion of this should be mixed with an equal quantity of hot water, and pieces of lint or soft linen, thoroughly wetted with it, should be wrapped freely round the joint, and some of the hot lotion poured over this dressing. The joint and dressing should then be enveloped in cotton-wool and covered with a layer of oil-silk. The foot should be raised a little above the level of the body and placed on a comfortable cushion or pillow and provided with a cradle to take off the weight of the bed-clothes. It is often remarkable how rapidly this application will relieve the pain in the joint.

We have already said that we do not approve of the internal use of opium if it can possibly be avoided; but in the feeble and debilitated, if the pain is excessively severe, and there is no evidence of renal disease, we may give 10 grains of Dover's powder, with half a dram of spirits of nitrous ether, in an ounce of camphor water occasionally. It is not often desirable to give morphine hypodermically. There is, however, no objection to a full dose of potassium bromide (30 grains), with tincture of hyoscyamus (½ dram), to quiet the nervous system and procure sleep.

During the acute attack the diet must be light and fluid.

Warm drinks to promote the action of the skin are useful. We should, therefore, limit the food to hot milk and water, thin oatmeal gruel, whey, weak veal or chicken broth; and we see no objection to an occasional cup of weak tea, with a little dry toast, as this often proves very refreshing and grateful to the patient. Many gouty patients will be found to object to milk as indigestible, especially if undiluted; but this objection may often be overcome by diluting the milk (hot or cold) with twice as much Apollinaris or seltzer water.

During convalescence the diet should still be very carefully restricted. A little boiled mutton, or chicken and rice, or a grilled sole or whiting with lemon juice, may be permitted once a day, and a poached or boiled egg with dry toast at breakfast. Beyond this only the light fluid foods already mentioned should be allowed. At this time a light bitter tonic, with some alkali, should be given twice daily, and we should be careful to see that the urine is maintained free from acid lithates, and that there is daily a free action of the bowels. The following mixture may be prescribed:—

℞ Potassii bicarbonatis ... ... ʒij.
Sodii bicarbonatis ... ... gr. lxxx.
Spiritus ammoniæ aromatici ... ... ʒiv.
Infusi calumbæ ... ... ad ℥viij.

Misce, fiat mistura. Two tablespoonfuls to be taken twice daily.

Any inflammatory thickening and impaired mobility left about the joint may require the application of iodine, or the rubbing in of the linimentum potassii iodidi cum sapone, together with gentle passive movements.

Some have advocated the treatment of the acute joint attack by quinine as an antipyretic, and in debilitated subjects we see no objection to the use of quinine in an effervescent alkaline mixture, according to a formula we have already given (vol. i., p. 646). Garrod has advocated a combination of quinine and alkalies in subacute cases.

In broken-down constitutions it may be needful to give a more generous diet during the acute attacks, such as whipped eggs, chicken or fish soufflés, in addition to gruel, milk, and farinaceous foods; and a certain amount of stimulant, such as 2 or 3 ounces of cognac or old whisky daily, diluted with hot milk, may be allowed.

The appropriate treatment of the constitutional state during the intervals, and of cases of chronic gout, will be, to a great extent, gathered from what has preceded. We have referred to the value of such medicinal agents as colchicum, guaiacum, potassium iodide, the salicylates, the alkalies, and the various mineral waters; and suitable formulæ for some of these will be given at the end of this chapter. Ammonium phosphate, ammonium chloride, sodium phosphate, have also their advocates for the treatment of chronic gout. The activity of the liver may be promoted by the occasional administration of a pill of colocynth (gr. iv.) and blue pill (gr. j.) at night, followed by a dram or two of magnesium sulphate in half a tumblerful of hot water in the morning. Gastric digestion may at the same time be promoted by giving a vegetable bitter with bicarbonate of sodium half an hour before the two principal meals. We may give 18 grains of sodium bicarbonate with 10 minims of tincture of nux vomica to one ounce of infusion of gentian. In what has been termed atonic gout, which we take to mean subacute and chronic gouty manifestations in feeble constitutions, stomachic *bitters* and aromatics have always been highly esteemed (such as the Portland powder), and their use has been popularised in the *Pistoja* powders for the treatment of chronic gout. These powders are prepared at the " Pharmacy of the R. R. Benedictine Sisters," at Pistoja, in Tuscany.* Some gouty patients have assured us that they have derived great benefit from their use. A powder has to be taken daily, in " half a glass of cold water or tepid coffee two hours before breakfast," for a whole year without interruption. " The blood must be under the essentially depurative action of the medicines for four entire seasons." These powders are asserted to contain " no colchicum or belladonna or other poisonous substances," but are composed " of medicinal herbs, none of which can have a bad effect on the patient." They are known to contain gentian.

It is certain that the most important point in the management of the gouty constitution is to keep assiduous watch over the digestive and assimilative functions; vegetable bitters with alkalies are of the greatest service in this respect. They should be given about an hour before the two principal meals. The bowels should never be allowed to become constipated, and the urine should be frequently examined, as slight abnormal changes in this excretion often furnish the earliest signs of disturbed retrograde metabolism.

Finally, we must consider the **dietetic** and **regiminal** treatment of gout.

It is universally admitted that in the treatment of gout, especially from the point of view of the prevention of future attacks, we must take largely into account questions of diet and mode of life. Apart from the influence of heredity, which is the chief etiological factor, no other cause is so influential in its production as habitual excesses or errors in eating and drinking; and, even when the hereditary tendency is strongly pronounced, very much may be accomplished by careful attention to dietetic rules, so as to keep in abeyance its more serious manifestations. It would, however, be a grave error to conclude that all the victims of gout merit the reproach of intemperance, or that they should all be submitted to the routine of a rigid abstinence.

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* Powders for a whole year (one daily) are supplied for 50 francs, and for six months for 26 francs.

The gouty should avoid a diet in which there is much fat or saccharine and starchy substances, on the grounds that by affording the system material for combustion, these substances tend to check the metabolism of nitrogenous compounds and prevent their complete elimination.*

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* In connection with the recent views of the relation of the *purin* bodies to gout, to which reference has already been made, it is held by many that the diet of the gouty should be specially free from purins. It may therefore be useful in constructing a dietary for the gouty to refer to the following table, from Dr. W. A. Pott's article on "Purin-free Diets" (*Lancet*, Oct. 6, 1906).

Purin Percentage Table

Meat

	Purins as grains per lb.		Purins as grains per lb.
Sweetbread	70·43	Loin of pork	8·48
Liver	19·26	Veal	8·13
Beef-steak	14·45	Ham	8·08
Sirloin of beef	9·13	Mutton	6·75
Chicken	9·06		

Fish

Salmon	8·15	Plaice	5·56
Halibut	7·14	Cod	4·07

Other Foods

Beans	4·16	Asparagus	1·50
Lentils	4·16	Onions	0·06
Oatmeal...	3·45		

Beverages

	Grains per pint.		Grains per teacup.
Porter	1·35	Coffee	1·70
Ale	1·27	Ceylon tea	1·21
Lager beer	1·09	Indian tea	1·05
		China tea	0·75

Milk, eggs, butter, white bread, rice, sago, cheese, are free from nucleins.

Each patient requires to be studied separately, especially with regard to digestive peculiarities; and our object should be to construct a dietary which shall be readily digested, and which does not tend to excite acidity and undue fermentation in the alimentary tract; and *that* diet will differ with different persons. An excess of nitrogenous food (animal flesh) should be specially avoided. Races who are vegetarian feeders are free from gout. On the other hand, we are quite satisfied that, in the present day, we often encounter the neurotic manifestations of this diathesis in persons who are delicate feeders with small appetites, and who consume a minimum rather than a maximum amount of food.

It is most essential to insist that the constituents of each meal shall be *simple and of like nature and mode of digestion.* One meal should be composed almost exclusively of nitrogenous food, another of fats and carbohydrates, and another of fruit, at proper intervals, and they will all agree and be suitable; but the contrary will be the case if they are mixed together in the same meal, one hindering the digestion of the other. Ripe and cooked fruit *taken alone* will be found beneficial to many gouty persons; but it should not be mixed with other kinds of food, for then it will disturb and delay digestion, and with many gouty patients *fruit of all kinds disagrees.*

A most important question in connection with the management of the gouty is the use of alcoholic drinks. In most persons, and especially in women, it is best to avoid them altogether; in others their moderate and discriminating use is not injurious. Of all alcoholic beverages, malt liquors are most prejudicial in this diathesis, and heavy, bad-quality wines. With regard to wines, it is not the name but the quality of the wine which is important; and a matured wine of fine quality will often be found to agree with a patient who would be made ill by the same wine when of inferior quality.

The wines which act freely as diuretics are the wines which agree best with all persons. In some this will be champagne, in others claret, in others hock, and so on.

A very eminent physician of New York told us that he found champagne and port—carefully selected—the best remedies for *his* gout. We have certainly known many gouty persons who found champagne the wine that suited them best. But it will also happen that gouty persons who have drunk champagne with impunity for many years will suddenly find that it provokes some form of goutiness which disappears on relinquishing the use of this wine. For those who find a certain amount of wine a necessity, it is advisable that they should add to the wine they drink a small quantity of an alkaline water. In the case of some feeble gouty patients we have found a glass of sound port, matured in *wood* and diluted with twice as much *hot* water, a harmless and comforting drink, especially in winter.

Still Moselle mixed with Apollinaris water is a good summer drink for thirsty persons who require a "big drink."

For others 2 or 3 tablespoonfuls of old whisky or good cognac daily, freely diluted with water, may be permitted. But it is undoubtedly better for the gouty person to abstain entirely from alcohol if he can do so with comfort. We have already insisted on the advisability of a free consumption of water by the gouty.

A great deal has been said about the importance of **exercise** for gouty persons, and no doubt a sufficiency of exercise is important to all persons. But gout is a disease which prevails amongst a class of persons who take a vast amount of physical exercise, and often of a very energetic kind, and so produce a large amount of nitrogenous waste. Moderate, regular, out-of-door exercise should certainly be inculcated, but excessive exercise we think injurious.

The comparatively slight incidence of gout in women as compared with men, who lead much more active lives, points in the same direction—viz. that want of exercise is not such an important factor in the etiology of gout as has been imagined. A due relation between food and exercise should, however, be observed ; women who take comparatively little exercise as a rule eat much less than men, and all those who find it impossible to take an adequate amount of exercise daily must restrict their intake of food accordingly.

As to **climate**, we are convinced that a climate that is warm, dry, and equable is most advantageous to the subjects of this diathesis, and that climatic conditions which interfere with the free action of the skin are most prejudicial. It is a matter of common observation with patients themselves that if the action of the skin gets disturbed by the onset of a cold east wind they soon begin to feel "gouty."

When there is a tendency to renal changes, or to recurrent attacks of subacute gout, it is advantageous, when possible, for such patients to winter in a warmer, drier, and more equable climate than that of England.

ADDITIONAL FORMULÆ

For acute gout

℞ Vini colchici, ʒss.
Magnesii carbonatis, gr. xv.
Aquæ cinnamomi, ℥j.

M. f. haustus. To be taken at bed-time. (*Brande.*)

Anti-gout tincture

℞ Tincturæ semin. colchici, ℥ss.
Tincturæ radicis aconiti, ℥ss.
Tincturæ guaiaci, ℥ss.
Tincturæ quininæ, ℥ss.

M. f. tinct. Thirty drops in a glass of ash-flower tea three times a day.

(*Dujardin-Beaumetz.*)

Mixture for chronic gout

℞ Potassii iodidi, ʒij.
Potassii bicarbonatis, ʒvj.
Vini colchici, ʒij.
Aquæ camphoræ, ℥xij.

M. f. mist. A tablespoonful three times a day in a wineglassful of water after meals.

(*Whitla.*)

Mixture for the gouty diathesis

℞ Lithii hippuratis, ʒj.
Syrupi aurantii, ℥j.
Aquæ ad ℥vj.

M. f. mist. A tablespoonful in water at bed-time.

(*Prof. Stewart.*)

Mixture for acute gout

℞ Tincturæ radicis aconiti, ʒj.
Morphinæ sulphatis, gr. ij.
Antimonii tartarati, gr. j.
Syrupi zingiberis, ℥ss.
Aquæ ad ℥ij.

M. f. mist. A teaspoonful every three hours.

(*Prof. Gross.*)

Pills for the gouty diathesis

℞ Extracti maidis stigmatæ, ʒjss.
Sodii benzoatis } āā gr. xl.
Lithii carbonati }
Olei anisi, guttæ iij.

M. et divide in pil. lx. Take two before meals thrice daily for twenty days in each month.

(*Huchard.*)

Gout pills

℞ Extracti colchici acetici, gr. xviij.
Extracti colocynthidis compositi, gr. xviij.
Pulveris ipecacuanhæ compositæ, gr. xviij.

M. et divide in pil. xij. One night and morning.

(*Halford.*)

Pills in gout

℞ Extracti colchici acetici, gr. vj.
Extracti rhei } āā
Extracti aloes socot. } gr. vj.
Extracti belladonnæ, gr. j.

M. et divide in pil. vj. One twice a week at bed-time.

(*Garrod.*)

Liniment for acute gout

℞ Morphinæ hydrochloridi, gr. x.
Linimenti belladonnæ, ℥iij.

M. et f. linim. A teaspoonful to be mixed with a tablespoonful of hot water, and applied on lint under oil-silk every four hours. (*Garrod.*)

Local application for acute gout

℞ Atropinæ, gr. iij.
Morphinæ hydrochloridi, gr. xv.
Acidi oleici, ℥j.

Solve ut f. linim. To be painted over the painful joint with a large camel-hair brush, and the joint wrapped in cotton-wool. (*Duckworth.*)

Liniment in gout

℞ Tincturæ opii, ℥j.
Linimenti saponis, ℥ij.

M. f. linim. To be kept in contact with the affected joint on flannel covered with oil-silk.

(*Prof. Gross.*)

Lotion for acute gout

℞ Sodii carb., ʒiv.
Linimenti belladonnæ, ℥ij.
Tincturæ opii, ʒij.
Aquæ ad ℥viii.

M. f. lotio. Mix a small portion with an equal quantity of hot water and pour on cotton-wool previously placed round the joint. (*Luff.*)

CHAPTER III

TREATMENT OF DIABETES

Definition and Nature of the Disease—Temporary or Alimentary Glycosuria—Glycogenic and Sugar-forming Functions of the Liver—Storage of Glycogen in Liver and Muscles—Claude Bernard's Views—The Normal Glycolytic Process in the Body suspended or impaired in Diabetes—Also a "*Hepatogenous*" Form dependent on Disturbances of the Glycogenic Functions of the Liver—*Slight* and *Grave* Forms, their Clinical Characters—*Pancreatic* Diabetes—Symptoms and Course—Diabetic Coma—Characters of Urine—Etiology—Treatment—Prophylactic — Dietetic — Exclusion of Carbohydrates — Muscular Exercise—Dangers of an Exclusive Dietary—Possibility of Modifications—Substitutes for Bread—Potatoes—Oatmeal—Permissible Foods and Beverages—Mineral Waters—Carlsbad—Vichy—Neuenahr—*Hygienic* Treatment—*Medicinal* Treatment—Opium—Morphia—Codeia—Alkalies—Arsenic—Potassium Bromide — Antipyrin — Sodium Salicylate — Aspirin—Jambul, etc. etc.—Pancreas and Pancreatic Extracts—*Treatment of certain Distressing Symptoms*—Thirst—Inflammation of Gums and Dental Caries—Constipation — Flatulence — Cutaneous Irritation—Cystitis—Diabetic Coma—Test Dietary — General Conclusions — Foods and Beverages sanctioned and forbidden — Labbé's Diet with Potatoes. Additional Formulæ.

DIABETES may be defined as a disturbance of carbohydrate and fat metabolism, characterised by the accumulation of sugar in the blood (*hyperglycæmia*) and its excretion in the urine, the amount of which is usually greatly increased, and is accompanied with thirst and commonly with progressive loss of weight. It may be as well to add, in the words of Dr. J. Rose Bradford, that "diabetes is not an entity, but a clinical label attached to a number of different conditions, with probably varied origins, different morbid anatomy, and liable to follow different courses."* Although the pathology and etiology of this disease and its manifestations are still involved in obscurity, and the treatment is almost wholly directed to the control of one symptom, the glycosuria, it will be advisable to discuss, briefly, one or two points connected with its pathology before we enter upon the consideration of its therapeutics.

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* *The Practitioner*, July, 1907, p. 13.

In health the starchy substances, together with the sugar, of our food (carbohydrates)—the former being converted into sugar in the processes of digestion—are, after absorption, ultimately wholly consumed and utilised, or stored up as glycogen for future use, in the body. None, or practically none, passes out of the body as sugar. In diabetes it is otherwise, and a more or less notable amount of sugar passes out of the body in the urine; and it has been found, by observation, that the amount of sugar passing out in the urine is usually proportionate to the amount of carbohydrates entering into the diet. Moreover, in one form of this disease, and that by far the *more serious*, sugar appears in the urine even when the food is restricted absolutely to proteids and fats, and when carbohydrates are totally excluded. This sugar must therefore be formed at the expense of the proteids of the food and of the tissues.

In health, the sugar which is taken into or formed within the organism is, directly or indirectly, utilised in the production of heat and energy; in diabetes a greater or less proportion of it escapes from the body unconsumed.

The *occasional* and *temporary* presence of variable amounts of sugar in the urine, in certain presumably healthy persons, appears to have no serious import, and is ordinarily referrible to the consumption of an excess of saccharine substances in the food, so that sugar is added to the blood more rapidly, or in larger quantity, than can be fully stored up as glycogen, or consumed in the metabolic processes, and is consequently excreted in the urine. This is termed *non-diabetic* or alimentary glycosuria.

In normal physiological conditions the carbohydrates of the food are eventually absorbed in the form of dextrose (glucose) and levulose. These sugars pass directly into the portal capillaries and not into the lymphatics; thus the portal vein carries to the liver "a stream of sugar," mainly dextrose. By a process of dehydration these sugars are converted by the liver cells into glycogen. After the ingestion of carbohydrates, the surplus that is not required for the immediate use of the economy is stored up in the liver as glycogen; this is subsequently reconverted into glucose, probably by the action of a special enzyme produced by the liver cells, and passing into the general circulation by the hepatic veins is conveyed to the tissues where it is oxidised, producing heat and energy. Besides the liver the muscular system also stores up large quantities of glycogen, equal in amount, probably, to that stored in the liver, but the muscles part with their store much less readily than the liver. The source of muscle glycogen is not definitely known, but it is probably derived from the glucose brought to the muscles by the circulating blood. The amount of glucose in the circulating blood of healthy persons remains constantly within the normal percentage limit of 0·1 to 0·2. Normally there is no loss of sugar in any of the excretions, except minute traces in the urine. If the supply of carbohydrates is insufficient, the stored glycogen is first used up, and when this is exhausted it is probable that the body proteids are converted into glucose; a few think the fats are so converted.

An excess of carbohydrates in the food can thus be stored up, within certain limits, in the liver and the muscles, as glycogen. A long-continued ingestion of a moderate excess of carbohydrates leads to an accumulation of fat in the connective tissue, but if there is a sudden ingestion of very large quantities, then the liver and muscles cannot store it all up as glycogen, nor can the organism convert it all into fat, therefore an excess of glucose accumulates in the blood and when this reaches more than 0·2 per cent. there arises *hyperglycæmia* and glucose appears in the urine; this is what we have referred to as "*alimentary glycosuria.*" This applies to *sugar*, not to *starch.* No amount of *starch* in the food will, in a healthy person, cause glycosuria. Digestion and absorption take so much time that a sudden flooding of the blood with carbohydrates cannot take place, therefore the occurrence of glycosuria after the ingestion of starch should lead to the suspicion that a true diabetic condition exists and that the power of storing up carbohydrates is lowered.

The view originally advanced by Claude Bernard is still generally accepted, that the blood in health always contains a certain amount of sugar, which is consumed in the capillaries, in the normal metabolic processes, and is ultimately eliminated in the form of carbonic acid and water.

Claude Bernard regarded the liver as a regulator of the sugar-forming and sugar-consuming processes, storing up in its cells glycogen by conversion of the alimentary glucose reaching it in the blood of the portal vein, and then, by reconversion of this glycogen into sugar, producing a fixed and constant supply of sugar to the blood.

Glycosuria, then, will occur under either of two conditions—(*a*) when sugar is added to the blood in quantity greater than can be consumed in the normal processes of nutrition; or (*b*) when the normal function of sugar destruction in the blood (glycolysis) is disturbed or arrested.

We may thus have diabetes dependent (*a*) on disturbances of the glycogenic functions of the liver, or (*b*) on disturbances of the metabolic (glycolytic) changes in the blood and tissues. As to the mode of oxidation of the carbohydrates, Cohnheim holds that the sugar of the blood is burnt up in the muscles through the agency of a glycolytic substance which results from the interaction of bodies produced in the pancreas and muscles.

Seegen termed the first group "*hepatogenous,*" and regarded it as comprising the slighter forms of diabetes, and he suggested that it was due to an inhibition of the functional activity of the hepatic cells devoted to the formation of glycogen, the cause of this inhibition being unknown. In the production of the second and *grave* form, he maintained, the glycogenic function of the liver had no share.

The clinical characters and the prognosis differ greatly in these two forms, and from the difference in their physical appearance French physicians have roughly divided diabetic patients into (*a*) *fat* diabetics and (*b*) *thin* diabetics.

Diabetics of the first group are usually well nourished and *often fat*, with a fresh complexion and a moist skin. They rarely suffer from the ravenous hunger, the excessive thirst, and the extreme polyuria of the second group.

Those of the second group emaciate with great rapidity. Their skin is dry and rough, the face pale or slightly livid, their muscular power is reduced to a minimum, their hunger is often insatiable, and their thirst and polyuria are usually excessive. The first form is usually seen in persons past middle age; the second form in the young. We must, however, be prepared to meet frequently with *intermediate* cases of very varying degrees of severity.

A further and most important distinction is that the diabetics of the first group lose wholly or partially their glycosuria, and the other symptoms associated therewith, on the withdrawal from their diet of all or great part of the carbohydrates; those of the second group, on the contrary, do not lose their glycosuria, even when restricted to an exclusive diet of proteids and fats, although the amount of sugar excreted may be diminished. Occasionally, the first form may pass into the second.

The two forms differ also in prognosis. With a suitable regimen, and a cautious and careful mode of life, diabetics of the first group may continue to discharge the active duties of life, the natural term of which may be but little shortened; those of the second form, to whatever *régime* they may be submitted, rapidly lose all their strength, become utter wrecks, and a fatal issue as a rule rapidly supervenes.

To the second and grave form must be referred those cases of **pancreatic diabetes** which have recently received special attention. Post-mortem examinations have shown that some exceedingly acute and grave forms of diabetes have been associated with serious structural changes in the pancreas, and experiments on animals have shown that extirpation of this gland is followed by a severe form of diabetes. But the extirpation must be *total*, for if but a small portion of the gland be left behind and the pancreatic duct be ligatured diabetes does not follow.

Only the graver forms of diabetes are now attributed to pancreatic disease, *i.e.* those characterised by rapid emaciation, great thirst and a high degree of glycosuria. Atrophy and fibroid overgrowth are the pancreatic lesions most commonly associated with severe diabetes But many serious forms of pancreatic disease are only exceptionally found to be accompanied with glycosuria, and it is rare for even transitory glycosuria to occur in malignant disease of the pancreas. It would appear that the variety of diabetes associated with pancreatic lesions is dependent "in a considerable proportion of cases on a peculiar form of chronic pancreatitis, leading to a diffuse intralobular fibrosis of the gland, and causing destruction of the islets of Langerhans. . . . The experimental results certainly associate the glycosuria with the *loss of an internal pancreatic secretion*, and Opie's results seem to show that in diabetes the islets of Langerhans have undergone degenerative changes, whereas they escape in the chronic pancreatitis unaccompanied with glycosuria."* It has been suggested that "in health the pancreas and muscles (and possibly other tissue cells) produce substances which, by their interaction on each other, yield a glycolytic body or ferment which is necessary for the proper combustion of the glucose in the body."*

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* Dr. Rose Bradford, *Practitioner*, July, 1907, p. 15.

The *chief* **symptoms** of the graver forms of diabetes are glycosuria, polyuria, excessive thirst, and hunger. The tongue is usually dry, red, and glazed ; the skin is dry and harsh, the bowels are constipated. Great and rapid emaciation occurs in the younger subjects. Itching of the skin and irritation of the genitals, eczema, boils, and carbuncles are apt to occur. Slight albuminuria is frequent. Pulmonary phthisis is a common termination of the graver form in *young* subjects ; and serious forms of pneumonia followed by gangrene of the lung are not uncommon. The same symptoms, but modified in the manner already referred to, occur in the slighter forms.

Diabetic coma is a most serious complication, and leads to a fatal result in many of the younger subjects of this disease. Its mode of causation is obscure. Before and during coma the urine frequently contains β-oxybutyric acid and its derivatives acetone and diacetic acid. It is a manifestation of an acid auto-intoxication, due to the abnormal presence of β oxybutyric acid in the blood. Formerly it was erroneously attributed to the action of acetone and diacetic acid, but these have been shown to be harmless.

Amongst things which favour the development of coma must be included constipation, excessive fatigue, and sudden changes in diet. It is considered probable that β-oxybutyric acid and its two derivatives are produced as a result of the *incomplete combustion* of *the fats* of the body, as well as those of the food. As a general rule the addition of moderate amounts of carbohydrates to the food leads to a diminution in the excretion of acetone as well as of the β-oxybutyric acid, when present, and *their withdrawal causes an increase !* When the capacity for oxidation in the body is not too much lowered, the presence of moderate amounts of carbohydrates in the food aids in the oxidation process and protects from destruction the fats, which are thought to be the main source of the acetone bodies. The presence of β-oxybutyric and diacetic acid in the urine should always serve as a warning of approaching coma. We shall see that the free administration of alkalies is mainly relied upon as a remedy for this condition, although only a temporary one.

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* L. B. Futcher: Osler's "System of Medicine," vol. ii., p. 760.

The **urine** in diabetes is usually excessively abundant; it varies, however, greatly in amount; in mild cases it may reach from six to ten pints, and in severe cases even to thirty and forty pints, daily. Occasionally we find the quantity of urine scarcely at all augmented. The density is usually high, but not always so, and we must not conclude that a urine is free from sugar because it is of low density. The specific gravity of the urine in diabetes ordinarily fluctuates, according to the amount of sugar it contains, between 1025 and 1050. The amount of sugar in the urine may vary from a mere trace up to as much as nearly 50 grains in the ounce, and the total amount excreted in twenty-four hours may range from a few grains up to twenty or thirty ounces! Diabetic urine is pale and clear, and does not deposit urates on cooling. *

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* "Since acidosis is one of the greatest dangers in severe diabetes, and since its presence is shown in the urine long before it gives rise to marked symptoms, it is necessary to have a clinical guide to the degree of the acid intoxication. . . . The best rough guide is the depth of colour of the diacetic acid reaction. Unfortunately the colour gradually fades and it is therefore not possible to keep standard solutions for comparison; but a very little practice enables one to judge by eye the depth of colour. The reaction is increased by cutting off carbohydrates from the food, by intercurrent attacks of nausea, by general anæsthetics and *enormously by alkalies;* it is diminished by the assimilation of carbohydrates and after spontaneous recovery from an attack of nausea . . . Alkalies such as bicarbonate of soda . . . alter the composition of the urine materially . . . the total quantity of urine is increased. The diuresis leads to a washing-out of nitrogen and dextrose from the tissues. In spite, however, of this increased glycosuria, alkalies actually improve the power of the body to assimilate carbohydrates. One other change is of *great clinical*

The division of diabetics into three groups, (1) *slight* cases, (2) cases of *moderate severity*, and (3) *grave* cases, is convenient, and is based on practical observation.

In the first group, with a dietary from which all carbohydrates are excluded, the sugar usually disappears entirely or almost entirely from the urine, and the patient's health is scarcely at all impaired. Such patients often belong to the gouty type; they are often fat, and although, before dieting, they may be passing several ounces of sugar daily in the urine, if put on a strict diet, after a few days the glycosuria will disappear; but a return to the ordinary diet will be attended by a reappearance of the sugar in the urine.

In the second group the excretion of sugar diminishes when a rigid diet is applied, but it does not disappear; or if it disappears, it soon returns; the patient may continue to lose flesh and to look ill, and the polyuria, the thirst, the hunger, and the other symptoms are still present, though favourably modified by treatment. These cases are prone to be attacked by intercurrent maladies such as pneumonia or phthisis and to pass into the third or *gravest* form. In this form, like the preceding, the excretion of sugar is not arrested by the strictest dietary, and these cases pursue a steadily downward course, no matter what treatment is adopted. The urine often gives a dark brownish-red coloration with ferric perchloride, owing to the presence in it of diacetic acid. This is an important sign as indicating the imminence of diabetic coma. In these grave cases the sugar excreted in the urine, when all carbohydrates are eliminated from the diet, must be formed at the expense of the proteids of the food and the tissues.

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importance, namely the fact that alkalies enormously increase the diacetic reaction in the urine. This increase can hardly indicate a greater acid intoxication, and must be due *to better elimination*."—"The Urine in Diabetes," by Dr. Beddard; "Action of Alkalies," *Practitioner*, July, 1907.

They therefore bear such a diet badly, and it is an error to enforce it.

Certain facts have been made out with regard to the **etiology** of diabetes. Hereditary tendency appears in a decided manner in a certain proportion of cases; it has been observed to follow, in some cases, traumatic and other lesions of the nervous centres; it has apparently been traceable occasionally to emotional shock, anxiety, and mental strain; a racial tendency has been noted, especially in Hebrews; this has been ascribed to greater instability of nervous system, fondness for sweets and over-eating and sedentary habits amongst the better classes. Though no age is exempt, it is rare in childhood, and is most common between 30 and 60 years of age; it occurs far more frequently in men than in women; and the *gouty* diathesis is supposed to be a predisposing cause, especially of the mild cases with favourable prognosis. Obesity has been also thought by some to play an important *rôle* in connection with the occurrence of the mild type of diabetes in persons of middle age, but this connection is not well understood. Von Noorden is of the opinion that the obesity is an early symptom of the diabetic condition, and that it develops long before glucose makes its appearance in the urine.*

We must now pass from this necessarily brief sketch of the general features of the disease to the consideration of its treatment. Some authorities, including Von Noorden, consider it desirable to adopt a *prophylactic* treatment in the case of those persons who are known to have a hereditary tendency to this disease. It has been advised that the capacity of such individuals to store up carbohydrates should be tested. This may be done by giving 100 grains of glucose on an empty stomach; if this causes glycosuria it may be inferred that this capacity is abnormally low, as a normal person should be able to take 180 to 250 grains without becoming glycosuric. In such cases the intake of carbohydrates should be restricted, and by this means Von Noorden thinks the development of diabetes may be prevented.

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* Certain poisons cause temporary glycosuria, as in what is known as "phloridzin diabetes." This substance is a glucoside derived from the trunk and root of apple, pear, plum and cherry trees, and when given by the mouth or injected subcutaneously in man and animals causes temporary glycosuria even when on a purely nitrogenous diet: the sugar must therefore be derived from proteids, and as there is no hyperglycæmia it must be due to action on the renal cells. *Adrenalin* is another substance which produces glycosuria, but investigations into this interesting effect are only at present in a rudimentary stage.

The **dietetic treatment** of diabetics necessarily occupies the foremost place in their management. By diet alone we can arrest the glycosuria in many cases of the slighter form, and diminish considerably the amount of sugar excreted in others. At the same time we diminish also the thirst, the polyuria, and other symptoms.

The principle which governs the construction of a dietary for the diabetic is the elimination of all those articles of food which either contain sugar or substances that can be converted into sugar in the organism; in short, all food substances containing carbohydrates.

This is not, in all cases, easy, as we have to consider also how to maintain the nutrition of these patients at an average standard, and we must be careful not to enforce too rigorously a diet which is obviously impairing the general strength and nutrition of the patient. It is especially necessary to bear this in mind in treating the *graver* forms, as they do not tolerate well a highly nitrogenised dietary.

In the *fat* diabetics, the well-nourished and sometimes gouty types, we may prescribe with advantage the strictest alimentary regimen; but with the emaciated subjects of the grave form of this malady we have a far more difficult task, for not only have we to consider how we can arrest or check the excessive excretion of sugar, but also how we may best control the co-existing grave disturbances of general metabolism. It is universally admitted that the basis of a suitable dietary for diabetics is the entire or partial exclusion of carbohydrates and their replacement by proteids and fats. Clinical observations also show that the amount of sugar excreted in the urine, so far as it is dependent on the diet, exercises a great influence on the well-being of the patient. The distressing thirst of the diabetic patient is determined by the amount of sugar in the blood, and we can only relieve the former by a diet which will also tend to diminish the latter.

Albuminates and fats, then, should form, as far as possible, the chief food of the diabetic, but some concessions will have to be made occasionally to the feelings and wishes, and sometimes to the real needs, of the patient. Moreover, the capacity for utilising sugar is not wholly lost in all cases, and patients have been found able, even in somewhat advanced stages of this disease, to metabolise a certain amount of carbohydrates. And the careful study of individual cases will often reveal a greatly varying capacity in tolerating different carbohydrates.

Muscular exercise, within certain reasonable limits, with the object of promoting glycolysis, has been strongly advocated. But it must not be overlooked that, in the grave form, physical exercise is badly borne, and that its chief value is in the well-nourished group. Indeed, many diabetics have to be earnestly cautioned against the risks attending any excess of physical exercise. It should be prescribed with great caution and moderation, and care must be taken that the diabetic patient is never fatigued. *Massage* is serviceable when exercise cannot be taken.

But apart from the tastes and wishes of the patients, there are certain physiological objections to a diet composed exclusively of proteids and fats. It tends to aggravate the disposition observed in many diabetics to an increased excretion of the nitrogenous elements of the urine, and especially to the formation of uric-acid deposits, and in the grave cases a prolonged restriction from carbohydrates is dangerous, as it favours those changes in the blood which induce coma

It is necessary to test from time to time the capacity of our diabetic patients to metabolise certain carbohydrates, and we may discover individual peculiarities in this respect which will enable us to enlarge the dietary in that direction for a longer or shorter period. We shall return presently to the mode of application of test diets.

Great practical difficulties arise in attempting to construct a dietary composed exclusively of proteids and fats; the amount of fat needed to supply the quantity of carbon required in the system is with difficulty appropriated by the organs of digestion, and to attempt to supply the necessary carbon by proteids alone would require a quantity of such foods altogether unmanageable. We are, therefore, driven to adopt a *mixed* diet, the various articles of which have to be chosen with special regard to the amount of sugar-forming substances they contain, selecting those which contain the minimum, and placing proteids and fats as the chief nutritive elements of the dietary.

The ingenuity of physicians has been greatly taxed to produce a *bread* for the diabetic that may form an efficient substitute for ordinary bread, which is so rich in carbohydrates. *Gluten* bread, suggested by Bouchardat, supplies this need only moderately well; it is often carelessly prepared, and many samples are found to contain a considerable proportion of starch, from which it is never entirely free; it is also dry and unpalatable. Gluten meal, too, is used for thickening broths and for making puddings. But it is desirable to test these preparations of gluten flour roughly with tincture of iodine before recommending them, as specimens of so-called gluten flour have been found to contain as much as 25 per cent. of starch. Messrs. Callard's casoid and casoid-meal loaf and their pro-lacto biscuits are palatable, free from starch and sugar, and contain about 50 per cent. of proteid.

"Torrified" bread—made by toasting thin slices of ordinary bread before the fire until they are deeply and thoroughly browned, almost blackened, so that the starch and gluten are in great part destroyed by heat—is acceptable to many diabetics. Cakes made of almond meal, from which the sugar has been removed by washing with acidulated water, have been recommended by Seegen and Pavy. Williamson gives the following instructions for making almond cakes: Mix 4 ounces of almond flour with a little water and German yeast, stand the mixture in a warm place for about 20 minutes (the yeast destroys the small amount of sugar in the almond meal). Add a beaten-up egg and a little water, and make the whole into a paste. Divide into cakes and bake for 15 or 20 minutes. *Cocoanut* cakes are made of desiccated cocoanut powder in the same way as almond cakes.

Ebstein advocated a bread for diabetics made of a patented gluten flour extracted by a new chemical process from wheat, and termed "*Aleuronat.*" It is composed almost wholly of vegetable albumen, with only 7 per cent. of carbohydrates and about 9 per cent. of water. He claims for it many advantages over other forms of gluten, amongst others that it can be transported to any climate without fear of decomposition or putrefaction. Protein flour (the basis of which is casein) is said to yield an excellent substitute for bread.*

Williamson has prescribed cakes composed of aleuronat, with cocoanut powder, as quite reliable, free from starch and sugar, and palatable to most diabetics. They are prepared by mixing 2 ounces of desiccated cocoanut powder into a paste with a little German yeast and water—this is kept in a warm place for about 20 minutes. Then 2 ounces of aleuronat are added, and afterwards a beaten-up egg, water, and a little solution of saccharine. The whole is well mixed, divided into cakes, and baked.

It is best when practicable that these preparations should be made at home, as they are then much less expensive and more reliable.

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* To be obtained from the Protone Co., Welbeck Street.

The starch of the *potato* has been thought, especially by French physicians, to be more easily assimilated than wheat starch. MM. Labbé and Mossé strongly recommend it as an alternative to bread and other carbohydrates. They permit the potato to be cooked in any way provided that it does not entail the use of starch or sugar.

Oatmeal, specially prepared, is another carbohydrate food which has been strongly advocated by Von Noorden as giving remarkably good results in certain cases. "The *oat-cure*," he observes, "as now prescribed by me, consists in the daily administration of 200 to 250 grammes of oatmeal, best given in the form of gruel every 2 hours; 200 to 300 grammes of butter and often about 100 grammes of vegetable proteid, or a few eggs may be taken in addition. Otherwise nothing else is allowed except black coffee or tea, lemon-juice, good old wine or a little brandy or whisky. . . The *oat-cure* rendered me immense service in *severe* cases, and I may even say that I have often succeeded in fending off incipient coma by its use. . . . One should under no circumstances allow other carbohydrates to be taken at the same time as the oatmeal." Von Noorden speaks well also of the "potato cure." He says, "I have thoroughly tested Mossé's statements, and can confirm the fact that with due attention to the principles laid down by him, potatoes can be much better tolerated than would be supposed from the amount of carbohydrates they contain." *

All kinds of animal flesh and fat are permitted (except liver), as well as preserved meats, when sugar has not been used to preserve them; also fish of all kinds, and eggs, cheese, butter, cream, and oil. No flour or starchy material must be used in cooking for the diabetic. Sardines in oil, anchovies, pâté de foie gras, caviare, cod's roe—these and similar relishes are all permissible. Green and fresh vegetables and salads (dressed abundantly with oil)—cabbage, spinach, sorrel, dandelion, lettuce, cucumber, watercress, mustard and cress—are permissible; and some physicians allow, in small quantities, green French beans, asparagus, celery, onions, and leeks.

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* For further details see Von Noorden's "Diabetes Mellitus," p. 190 *et seq.* Bristol: John Wright and Co., 1907.

All vegetables and fruits containing a large proportion of starch or sugar must be forbidden. Some authorities consider a moderate amount of fresh acidulous fruit permissible—such as gooseberries, currants, apples, etc.

The best test, however, of any article of diet is its effect on the urine, and with daily observations of the urine it is easy to determine individual peculiarities in this respect. We should also weigh our patients frequently, so as to observe the effect on their general nutrition of the dietary adopted. This is a most important precaution and an excellent test of the suitability of any diet to the particular case. When the patient's weight is maintained or increased it is pretty certain that his diet is well chosen. We are speaking of the "thin," not the "fat" diabetics.

The diabetic patient suffers much from thirst, and it is therefore a question of some importance *what he may drink.* Alcoholic beverages should only be allowed in small quantity, as the temptation to excess is great. There is, however, no harm in a little non-saccharine wine, such as claret, hock, or still Moselle, diluted with water or with some effervescent alkaline water; or small quantities of whisky, brandy, or dry gin, largely diluted, may be substituted if required.

When the food contains much fat a little alcohol, taken at the same time, appears to aid its digestion.

There is no objection to light infusions of tea, coffee, maté, or kola, and these may be sweetened with a little saccharine. A sugar-free *milk* has been prepared by Messrs. Callard, Regent Street, which may be found useful.

The **food indications** may be thus summarised:—1. Avoid, or reduce to a minimum, all substances containing starch or sugar. 2. Give as much animal food—meat of all kinds—as can be comfortably digested and assimilated, *so long as it agrees with the patient.* 3. Replace the discarded carbohydrates by suitable substitutes from amongst the various animal and vegetable fats and oils. 4. In the stout and well-nourished, encourage muscular exercise to consume the excess of sugar in the blood; but do not push this to the extent of producing fatigue, which is injurious. By these dietetic measures the characteristic symptoms of all but the gravest forms of this disease may be ameliorated, while those of the slighter forms will wholly, or to a great extent, disappear. But it would be an error to conclude that these cases, save in exceptional instances, are *cured.* A return to ordinary diet with a full supply of carbohydrates will usually be attended with a return of the glycosuria, and such persons have to continue a more or less careful observance of the regimen we have sketched for the rest of their lives.

It has, however, been pointed out that it occasionally happens that the nutrition of a diabetic patient will improve on the addition of a little carbohydrate to his dietary, although at the same time an increased amount of sugar may be passed in the urine. This is due to the albumen-sparing action of the carbohydrates, so that they lessen nitrogenous metabolism, in diabetics of a severe type. The dietetic rules must therefore not be made too absolute, as it will happen, now and then, that the addition of a little ordinary bread to the dietary will be attended by an increase in weight, and an improvement in nutritive condition, in certain cases, while with some patients a great excess of animal food is badly tolerated. We must be on the alert to note such peculiarities, and we must remember that every case requires individual study.

Next, perhaps, in importance to treatment by diet is treatment by **mineral waters.** The efficacy of certain mineral springs in the treatment of some forms of diabetes is well known to practical physicians. The alkaline, the alkaline and aperient, and the alkaline and arsenical waters are those chiefly employed. Neuenahr, Vichy, Carlsbad, and Bourboule may be taken as types of these. In what precise manner they act it is difficult to say, but there can be little doubt that alkalies do exercise an important influence over metabolism. With regard to Carlsbad, Professor Seegen, who practised there many years, and had seen more than a thousand cases, testifies that the Carlsbad course is of real utility, but only in the *slighter* forms of the disease, not in the *grave* form. He considers the Carlsbad water acts by augmenting and maintaining for a time the tolerance of starchy foods, and that this may be explained by a special action on the hepatic cell, which under its influence recovers the faculty of utilising the starchy substances ingested. "If we remember," he says, "that the Carlsbad water certainly exercises a favourable action on all the functions of the liver, it will not seem extraordinary that we should attribute to it an analogous influence on the slight form of diabetes—that is to say, on hepatogenous diabetes."*

Our own experience extends especially to Vichy, Carlsbad, and Neuenahr, and we have observed most satisfactory results from treatment at these spas in all cases of diabetes, except those of the *grave* form, and we are not aware that any kind of treatment has ever done more than produce slight and temporary amelioration in the latter group of cases. Dr. Débout d'Estrées testifies to the value of Contrexéville water in the case of gouty diabetics. He says that "stout diabetics" and "gouty diabetics" rapidly lose their glycosuria there. We should be particularly careful as to permitting cases of the *grave* form to undertake the fatigue of a long journey to a distant Continental resort, although they may be eager to try it.

The use of certain of these alkaline waters should enter into the daily regimen of diabetic patients.

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* "La Glycogénie Animale," p. 242.

They tend to diminish the excessive thirst and the distressing dryness of the mouth, to lessen the frequency of micturition and to allay cutaneous irritation. If we prescribe the stronger alkaline waters, such as Vals or Vichy, we may order from 3 to 6 ounces to be drunk half-an-hour before each meal; but the weaker waters, such as Apollinaris or Ems water, may be taken in larger quantity and may be used to mix with wine.

It is of great importance to protect the diabetic patient from any depressing influence, and from exposure of all kinds, as it is well known he bears any pulmonary or other attack of intercurrent disease badly. He should therefore be warmly clad, and should avoid any risk of chill from exposure to inclement weather. He should be protected from worry, fatigue, and strain of all kinds—emotional, intellectual, and physical. It is an advantage, when practicable, to pass the winter in a sunny, dry, and sheltered locality.

With respect to the utility of **drugs** in diabetes, it must be borne in mind that, in the lighter cases, the disease can be kept entirely under control by means of such dietetic and general measures as we have already set forth, and that drugs are not needed. We are not, of course, alluding to occasional aperients, antacids, or simple remedies of like nature. We would also point out that no method could be more misleading than that of prescribing drugs as remedies for the diabetic state *at the same time* that we are applying a rigorous dietary, unless we have first ascertained that the amount of benefit to be derived from dietetic treatment is limited; otherwise we run the risk of attributing to the use of the drug benefits that may be wholly due to the diet. We should first, then, ascertain to what extent the symptoms are amenable to diet, and when we find that the most rigorous diet only leads to a moderate or small diminution in the quantity of the sugar excreted in the urine, we may fairly have recourse to drugs, and may reasonably attribute to them such amelioration as can be observed to follow their employment.

The only drug that has gained universal acceptance in the treatment of diabetes is **opium.** Some give the preparations of opium itself, and think them preferable ; others give morphia ; and others, including Pavy, give codeia. Seegen found morphia and Carlsbad water the two most efficacious remedies in diabetes, and he testifies that morphia incontestably diminishes the amount of sugar excreted in the urine in both forms of the disease. Although Pavy maintains the superiority of codeia, which is less constipating than morphia, and disturbs digestion less, many others consider the latter the most suitable and most efficacious remedy. Codeia should be given at first in small doses, $\frac{1}{2}$ grain three times a day, and this dose may be increased gradually to 4 or 5 grains thrice daily ; or the watery extract of opium may be given in much the same dose as codeia. If we use morphia, we must begin with a smaller dose, $\frac{1}{6}$ grain thrice daily, and slowly increase it, if necessary, to 1 grain three times a day.

Diabetic patients tolerate large doses of opiates remarkably well, and large doses are often needed in order to produce any decided effect ; but we do not approve of giving them in a routine manner, and we consider, as we have already indicated, that they should be reserved for those cases that cannot be effectively controlled by diet. In the *graver* forms they no doubt serve a useful purpose ; together with a careful diet, they seem to hold the disease in check. How they act is not known. Recent observations would seem to show that they are especially adapted to hinder the production of sugar when it takes place at the expense of the proteids. Their quieting effect on the nervous system is doubtless of some importance.

The effect of opiates must, of course, be carefully watched. and on observing any untoward effects, such as drowsiness, great loss of appetite, or disturbed digestion (these rarely occur when codeia is given), they must be withdrawn or greatly reduced in quantity. They are rarely indicated when albuminuria complicates glycosuria, and, if given, should be administered with great caution. Williamson objects to their constipating effect, especially in very severe cases, as constipation appears to increase the tendency to coma. He has found *heroin hydrochloride* less constipating than morphine, and in some mild cases in which he gave it he thought it beneficial.

Of the value of **alkalies,** as represented by alkaline mineral waters, we have already spoken, but they may also be prescribed in the form of medicines, and often with great advantage. The amount of sugar in the urine has been observed to diminish steadily under alkaline treatment. It is possible they may exercise a favourable influence over the hepatic functions. Experimental observations seem to point to their exercising a twofold remedial action, viz. promoting glycolysis in the blood and tissues, and retarding the conversion of glycogen into sugar in the liver.

The bicarbonates of sodium and potassium have been largely employed, and so also have the citrates and tartrates. Of their influence, in large doses, in the prevention and temporary relief of diabetic coma we shall again have to speak.

Arsenic has been said to inhibit sugar formation in animals, and the *bromide of arsenic* has enjoyed a considerable reputation, especially among certain American physicians, in the treatment of diabetes. A 2 per cent. solution is used, and the dose is 1 minim, gradually increased to 5 minims, given after meals, thrice daily. It is said to diminish thirst and polyuria, to lessen the glycosuria, and to be particularly serviceable in cases of a neurosal type. Fowler's solution has also been given in large doses up to 12 or 15 minims, according to the tolerance of the drug. Professor Tyson* is an advocate of this treatment, but he does not give such large doses; he finds that much benefit in certain cases attends the use of Fowler's solution in 4-minim doses, twice a day. Professor Renaut, of Lyons, gives sodium cacodylate, by rectal injections, in the dose of 2 or 3 centigrammes daily.

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. i., p. 671.

Potassium bromide, 15 to 30 grains daily, given in association with alkalies, has been credited by several trustworthy observers with the power of causing the sugar to disappear from the urine; others, however, object to its use on account of its depressing effects, or insist that its administration should be limited to those cases in which nervous irritability is a prominent symptom, and in which there exists a certain amount of physical vigour to support the lowering influence of this drug. Lépine doubts its utility except as a nerve sedative. The sodium bromide may be combined with a nervine stimulant, such as the ammoniated tincture of valerian. Valerian itself was a favourite remedy with Trousseau for polyuria.

Antipyrin and allied antipyretic drugs have been advocated by the French school as remedies for the polyuria and the glycosuria. A diminution of the amount of urine and sugar excreted has been observed to follow the exhibition of antipyrin in doses of from 10 to 15 grains thrice a day. Lépine thinks it a valuable remedy in the nervous form of diabetes, and that the action, probably through the nervous system, is to prevent the formation of sugar. Osler also thinks its use satisfactory in the same class of cases. It is, however, a medicine to be avoided when there are any signs of renal irritation, as some observers have imagined they could trace the occurrence of albumen in the urine to its use.

Sodium salicylate and *aspirin* have recently found a warm advocate in Williamson. In a number of mild cases he has found that they cause a considerable diminution in the amount of sugar excreted, although the diet has been kept exactly the same. He admits, however, that they are of little use in the severe form, and without influence in certain of the mild cases; we may therefore probably conclude with Professor Tyson that they are chiefly useful in the gouty cases.

Williamson begins with 10-grain doses of the salicylate three or four times a day, and gradually increases them to 15 grains four times daily. He watches carefully for toxic symptoms, and discontinues the drug if they occur. He prefers the *natural* salt. *Aspirin* he thinks agrees better with some patients. He gives it in the same doses as the salicylate.

Most diverse reports have been made as to the efficacy of **jambul** in the treatment of diabetes.

Professor Colasanti, of Rome, and Lépine report experiments which show that it has some influence in hindering the production of sugar. It has been suggested that those who have reported against it as worthless have worked with specimens of inferior quality, or have not given sufficiently large doses. The dose of the liquid extract is ½ dram to 2 drams. Larger doses have been given.

Uranium nitrate, in doses of 1 to 5 grains, has been given by S. West and others in cases of diabetes, and excellent results have been reported. We have tried it in moderately severe cases, but without any notable effect. It should be borne in mind that in the *slight* cases many remedies appear to be of use, but it is for the *grave* cases we need a remedy, and that remedy has not yet been found.

Numerous other drugs have been given in diabetes, with temporary benefit and occasional relief of some of the symptoms; but their introducers have not succeeded in obtaining for them more than a brief popularity.

The recent researches into the relation between diabetes and disease of the **pancreas** have led to some therapeutic suggestions which we must briefly notice. Sheep's and calves' pancreas have been given *raw;* the pancreas of the ox has been given roasted; minced pancreas, infused in a suitable solution, has been administered by rectal injection; an extract in glycerine and water has been given hypodermically; pancreatic juice has been given in the same way, but no remarkable success has followed pancreatic treatment. Williamson testifies that "pancreatic preparations have generally been useless."

Certain **distressing symptoms** associated with this malady may call for remedial treatment. The *excessive thirst* will, of course, be diminished by whatever lessens the polyuria, or the amount of sugar in the blood; but when we fail in this, or only partially succeed, we must minister directly to the relief of this distressing symptom. There is no good reason why the patient should not drink freely of water; indeed, it is rational to expect that by adding to the blood considerable quantities of pure water we shall help to prevent the undue accumulation of sugar in the circulating fluid, as well as minister to the relief of thirst.

Lépine has wisely said that the diuresis is a "means of defence to the diabetic," and the free consumption of water favours that "defence."

We should arrange, however, that large draughts of water should precede and not immediately follow a meal, so as not to dilute too greatly the digestive ferments. The addition of a few drops of phosphoric acid, or of lemon-juice, or of a solution of bitartrate of potash to the water may be made if it is found to allay the thirst better; but nothing will clean and refresh the mouth so much as some weak alkaline water. The *dental caries and inflammation of the gums* so common in diabetics, from the morbid fermentations set up in the saccharine secretions in the mouth, are also beneficially affected by weak alkaline drinks.

An alkaline and antiseptic mouth-wash should be used frequently. Listerine may be employed for this purpose, or 2 drams of borax, 1 dram of boric acid, and 1 dram of potassium chlorate may be dissolved in 1 pint of camphor water for a mouth-wash.

The intense craving for food and sense of *sinking* in the epigastrium, experienced by some patients, are relieved by 2 or 3 grains of asafœtida in a pill two or three times a day.

Constipation may require an occasional or even a daily aloetic pill, followed the next morning by a glass of Carlsbad or half a glass of Apenta water. Flatulence and intestinal catarrh, from abnormal fermentation in the bowels, are best relieved by an initial aperient, together with a dose of creasote or thymol in a pill twice or thrice a day, after food; or the *salicylate of bismuth* may be given if there is a decided tendency to diarrhœa.

Intense itching of the skin and great irritation about the genital organs from the repeated contact of saccharine urine require attention. The surface of the body should be frequently sponged with tepid water, and some absorbent material worn next the skin, such as thin flannel, which should be frequently changed. The genitals should be kept thoroughly clean, and some absorbent cotton-wool applied immediately after micturition. Eczema of the prepuce may require boric acid ointment.

Cystitis, which occasionally occurs, is best treated by washing out the bladder with a weak solution of sodium salicylate, and by giving this drug, or salol, or boric acid internally.

The supervention of **coma** in the diabetic is one of the most serious symptoms we can encounter, and is almost always fatal. Some authorities think that the occurrence of coma may be prevented, in cases in which it is feared, by the frequent exhibition of saturated solutions of alkalies—such as 4 drams of sodium bicarbonate and 2 drams of citric acid dissolved in 5 ounces of water and flavoured with a little saccharine and essence of lemon. This should be taken twice or thrice daily.

Those who believe the coma to be due to the absorption of toxines from the alimentary tract advocate free purging.

Williamson believes the alkaline treatment, although it may not have much influence on sugar excretion, has a decided action in preventing diabetic coma. He gives very large doses of sodium bicarbonate, 200 to 400 grains a day, in large quantities of water, soda-water, or milk, drunk in small quantities at frequent intervals. Saline purgative waters of the Apenta type should be given regularly at the same time to maintain free action of the bowels. If the pulse is very feeble, small doses of digitalis should be given, and strychnine may be useful. When coma is commencing he has given as much as 900 grains of sodium bicarbonate in twenty-four hours. Subcutaneous or intravenous injection of alkaline fluids has been carried out in many cases of actual coma with the object of diluting the blood and restoring its alkalinity. Normal salt solution has been used in the same way. Oxygen inhalations have also been used, but the alkaline and saline injections have given the best results, though the improvement is usually only temporary. Intravenous injection is preferable to the subcutaneous method. The following solutions have been used for this purpose, besides the normal salt solution, viz. a 3 per cent. solution of sodium bicarbonate in water; a solution of 10 grains of sodium bicarbonate, and 7 grains of sodium chloride in 1 litre of sterilised water. A large quantity, from 60 to 80 ounces, should be used, and the temperature should be about 100° to 101° F.

Lépine advises reliance being placed on (1) alkaline medication, (2) the intravenous injection of salines, and (3) oxygen inhalations.

Finally, and to recapitulate, in dealing with individual cases of diabetes, it is important at first to determine to which group of diabetics the patient belongs—to the slight, the severe, or the intermediate group. For this purpose we must apply a test diet. Much useful information may be obtained in this way.

The following is Von Noorden's test diet:—

Breakfast.—200 grammes (8 oz.) of tea or coffee with 1 or 2 tablespoonfuls of thick cream, 100 grammes (4 oz.) of cooked meat, butter, 2 eggs with bacon, 50 grammes (2 oz.) of white bread.

Lunch.—Two cooked eggs, cooked meat, 200 to 250 grammes (8–10 oz.).
Vegetables (spinach, cabbage, cauliflower, or asparagus with sauce or gravy without flour, but with butter, eggs, etc.).
Creamy cheese (Camembert, Brie, etc.), 20 to 25 grams (about 1 oz.), plenty of butter.
Two glasses of red or white wine, if desired.
One small cup of coffee with a tablespoonful or two of thick cream, 50 grammes (2 oz.) of white bread.

Dinner.—Clear meat soup with egg or green vegetable in it.
Meat as at lunch.
Vegetables as at lunch.
Salad of lettuce, cucumber or tomatoes.
Wine (no bread).

Beverage during day (exclusive of wines), one or two bottles of Apollinaris or seltzer water.

If on this diet no sugar appears in the urine, the quantity of bread is gradually increased until sugar does appear in the urine. On the other hand, if with this test diet sugar does appear in the urine, the diet is maintained till the daily quantity of sugar excreted has become nearly constant. Then the quantity of bread is gradually diminished until the urine becomes free from sugar while there is yet bread in the daily fare, in which case we have to do with a *slight form* of diabetes and we learn also the *tolerating capacity* of the patient for carbohydrates. This capacity will be found to vary greatly, and will determine the particular diet suited to each individual. If, however, we find that with this test diet the urine does not become free from sugar until bread is totally excluded, then we know we have to do with a *severe form* of diabetes. In other cases even the total exclusion of bread does not prevent the appearance of sugar in the urine, and the proteids have to be reduced before the urine becomes sugar-free. Von Noorden classifies the two latter forms as *moderately severe* and *severe* cases, and he terms *most extreme* cases those which continue to pass sugar in the urine even with a total exclusion of carbohydrates from the diet, together with a reduction of proteids. Having by means of a test diet determined the form and severity of the case with which we have to deal, we are in a position to prescribe a suitable dietary, remembering the principles of treatment already laid down.

If in intermediate or moderately severe forms we can by diet keep the excretion of sugar at or below 400 or 500 grains a day, and at the same time maintain the patient's weight and strength, there is little need for drugs; but when we fail to do this it may be desirable to have recourse to their aid.

Our guide must be not so much the amount of sugar in the urine as the general condition of the patient with respect to weight and strength. In the slight cases and with fat diabetics a fairly rigid diet may be maintained for some time, and then we may test the capacity for assimilation of sugar by the cautious addition of carbohydrates to the dietary, best, usually, in the form of ordinary bread; for it has been found in many cases that after the continuance of a rigid diet for a certain time the tissues recover, to a certain extent, the power of assimilating sugar. Each case then requires careful watching, and a frequent estimation of the amount of sugar excreted daily, and of the gain and loss in weight, and of the influence of variations in diet on both.

In the construction of diabetic dietaries the following foods and beverages are **sanctioned:**—

In any quantity.—Animal flesh of all kinds: preserved (smoked) meats, ham, tongue, bacon; fish of all kinds; crabs and lobsters (not the "pudding"); animal jellies, soups, and broths; aspic; eggs, caviare, cream, butter, fats, oils, and cheese; spinach, cooked salads, endive, lettuce, spring onions, cucumber, green asparagus, mustard and cress, watercress, sorrel, mushrooms; pickles (cucumbers, walnuts, and onions); nuts, except chestnuts.

In small quantity.—Cauliflower, carrot, turnip, white cabbage, green beans; *berries*, such as *strawberries, raspberries, currants;* also oranges

Reliable substitutes for bread.

Beverages: in any quantity.—Water, table water such as Selters, Apollinaris and the like; tea, coffee; *in moderate quantity*, Bordeaux and Rhine and Moselle wines; Austrian and Hungarian table wines. In short, all wines that are not sweet, and that contain only a moderate amount of alcohol.

In small quantities.—Milk when well tolerated; brandy or whisky; lemonade, unsweetened.

The following are **forbidden**:—

Farinaceous foods of all kinds; bread, puddings, cakes, biscuits, etc.; sugar, potatoes, rice, tapioca; arrowroot, sago, groats, macaroni; parsnips, beetroot, beans, peas, large onions; sweet fruits, as grapes, cherries, peaches, apricots, plums, and all kinds of dried fruits; liver; oysters, cockles, mussels, the "pudding" of crabs and lobsters.

Beverages:—Port, champagne, and all sweet wines and beers, must, fruit wines and fruit juices and syrups; sweet lemonade; liqueurs; ice and sorbets; cocoa and chocolate; and milk in large quantities.

The following is a diabetic diet constructed by Marcel Labbé in which *potato* is the only carbohydrate.

Early breakfast.—Black coffee 6 oz., with cream 2 oz.
Lunch.—Two cooked eggs, with 1 oz or 1½ oz. of bacon or ham, ⅓ oz. of butter.
6 oz. cooked meat, ½ oz. butter; or fish or lobster with ½ oz. butter.
Vegetables, green (spinach, asparagus, cabbage, etc.), 6 oz. cooked, with ⅓ oz. of butter, or 6 oz. fresh salad with oil and vinegar.

Cheese $\frac{2}{3}$ oz. with $\frac{1}{3}$ oz. butter or $1\frac{1}{2}$ oz. of cream cheese.
Potatoes, $3\frac{1}{2}$ oz.
Beverage, 1 glass of red wine, 2 pints of water (!), $3\frac{1}{2}$ oz. black coffee.

Five o'clock tea.—Tea 6 oz., with $\frac{2}{3}$ oz. of ham or potted meat.

Dinner.—*Hors d'œuvre* of sardine, herring, etc., with $\frac{1}{3}$ oz. butter.
Bouillon or onion soup (strained), $\frac{1}{2}$ pint.
Meat, cooked, $3\frac{1}{2}$ oz., with $\frac{2}{3}$ oz. butter.
Salad, fresh, $3\frac{1}{2}$ oz., with oil and vinegar.
Cheese, $\frac{1}{3}$ oz., with $\frac{1}{2}$ oz. butter or $\frac{1}{2}$ oz. of vanilla or coffee cream.
Potatoes, $3\frac{1}{2}$ oz.
Beverage, 1 glass of wine; camomile or lime tea.

He recommends for the grave cases with failing nutrition a mixed diet consisting of *proteids*, in order to ward off loss of nutrition; *fats*, to supply calories; *carbohydrates*, to keep the system alkaline. These should be abundant in quantity so as to prevent wasting and satisfy the polyphagia.

ADDITIONAL FORMULÆ

Lithium pills for diabetes

℞ Lithii carbonatis, gr. xxx.
Sodii arseniatis, gr. j.
Extracti gentianæ, gr. xv.

M. et divide in pil. xx. A pill night and morning.

(*Vigier.*)

Lotion for the itching

℞ Sodii hyposulphitis, ℥ss.
Aquæ, ℥vj.
M. f. lotio. (*Osler.*)

Another

℞ Acidi hydrocyanici dil., ʒj.
Glycerini, ℥j.
Aquæ ad ℥vj.
M. f. lotio. (*Dawson.*)

Infusion of eucalyptus leaves in diabetes

Mr. Faulds, of Glasgow, reports remarkable results from giving twice daily an infusion of 60 grains of the dried leaves of eucalyptus globulus in 6 oz. of water, infused for half an hour in a teapot and a little saccharin added (*Brit. Med. Journal*, May 24th, 1902).

Iodoform pills for diabetes

℞ Iodoformi, gr. xv.
Extracti lactucarii, gr. xv.
Cumarin, gr. jss.

M. et divide in pil. xx. One three times a day.

(*Moleschott.*)

Mouth-wash for diabetics

℞ Boracis
Potassii chloratis } āā ʒj.
Glycerini
Mucilaginis acaciæ } āā ℥j.
Aquæ ad ℥viij.
M. f. lotio. (*Packard.*)

Another

℞ Boracis, ʒij.
Tincturæ myrrhæ, ℥ss.
Aquæ ad ℥vj.

M. f. lotio. To be used with an equal quantity of warm water. (*Dawson.*)

Anti-diabetic syrup

℞ Antipyrin, gr. cl.
Saccharini, gr. iij.
Sodii bicarbonatis, gr. ij.
Infusi caffeæ, ℥v.

M. f. mist. A tablespoonful twice or thrice daily.
(*Bardet.*)

CHAPTER IV

TREATMENT OF RACHITIS OR RICKETS; OF SCORBUTUS OR SCURVY

Rickets—A Disease of Nutrition—Dependent on Dietetic Defects—Other Causes—Insanitary Surroundings—Symptoms and Characters of the Disease—Frequency of "Nervous" Symptoms—*Indications for Treatment*—Preventive and Remedial—Mainly Dietetic and Hygienic—Cream—Cod-liver Oil—Raw Meat Pulp and Juice—Fresh Air and Sea Air—Clothing—Measures to Prevent Deformity—Treatment of Diarrhœa—Tonics—Iron—Arsenic—Phosphorus—Sedatives.

Scorbutus or Scurvy—A Dietetic Disease—Theories as to Causation—Clinical Features—*Indications for Treatment*—*Prophylactic*—*Curative*—Mainly Dietetic—Mouth Washes—Quinine and Iron—Strychnine—Baths and Massage. *Infantile Scurvy*—Dependent on Dietetic Defects—Symptoms—Indications for Treatment—Diet—Potash Salts.

Additional Formulæ.

It will be convenient, in the present chapter, to consider the treatment of the above-named diseases, although their pathological affinities may be somewhat remote.

Rachitis

Rachitis or *rickets* is a disease of nutrition, common in infancy, said, indeed, to be the most frequent disease of that period of life. It nearly always originates between the ages of three months and three years. Some cases are, however, of undoubted congenital origin, and are characterised by the presence of curvatures and fractures of bones, that have arisen either *in utero* or during parturition. On the other hand we must admit the rare occurrence of "late rickets," commencing some years after three, but commonly as a recurrence in one who has suffered from rickets before that age.

It is essentially a disease that originates in faulty feeding, aided by certain contributory causes. It is far more common in hand-fed than in breast-fed infants, although it may be traced to prolonged lactation and suckling during pregnancy, when the mother's milk is poor and deteriorated. Even then, however, it is questionable whether much should not be set down to the account of the improper food that is apt in such cases to supplement the mother's milk. Chronic diarrhœa, which may itself depend on unsuitable food, not unfrequently precedes this disease. The fault in the diet upon which the occurrence of rickets depends is poorness in animal proteids and fats, and excess in carbohydrates, especially starch, a fault which prevails in most proprietary foods and in condensed milk, which are so largely given to hand-fed infants. Deficiency of fat is decidedly more important than deficiency in proteid, and perhaps some even of the harm caused by excess of carbohydrates is due to their interference with the digestion of fat. Other contributory causes are a deficiency of fresh air and sunshine; overcrowded, insalubrious houses; and city, as compared with country, life. Hence this disease falls mainly on the poorer classes, but it also attacks the children of the well-to-do, and can then usually be traced to faulty feeding. We must confess to complete ignorance as to the connection between the dietetic errors and the defective deposition of lime salts in the bones. Deficiency of lime salts in the food is not the cause. for many children develop rickets, though the milk has been habitually diluted with lime water; again, cow's milk contains more lime salts than human milk. It has been suggested that fat aids in the absorption of calcium phosphate from the intestine, and that when fat is deficient this salt is eliminated in the fæces. Analysis of the fæces in rickets lends support to this view.

Inherited syphilis has been put forward as a cause of rickets, but it has been pointed out that although syphilis may modify rickets it does not originate it. Though the organs generally are affected by the defective nutrition thus induced, the more obvious features of this disease are connected with disturbances in the order and regularity of the processes of ossification, and with a marked diminution of calcareous salts in the bones. The epiphysial ends of the bones become enlarged; there is abnormal vascularity and softness; the shafts of the long bones are thicker and bend more easily. These pathological disturbances lead to well-known and characteristic changes in the skeleton. There is deferred closure of the cranial fontanelles and sutures, increased prominence of the frontal and parietal eminences; thus giving rise to a square, broad, prominent forehead, a flat vertex, and often to some asymmetry of the skull from pressure on the softened bones. The jaws become beaked from lateral flattening. The teeth appear late and decay early. This *tardy dentition* is an important feature in the disease, and its occurrence should make us suspect the onset of rickets. Then we have the so-called "rickety rosary," the beading of the ribs at their junction with the cartilages. There are also often lateral and basic grooves from pressure on the thorax, or defective expansion and collapse of the lungs, so that the sternum with the cartilages of the ribs is carried forward and gives rise to one form of pigeon breast. The dorsal spine is convex from forward curvature. The abdomen is tumid and flabby, and some authors describe an enlargement of the liver and spleen in anæmic cases. Pelvic deformities may arise, and may be of serious concern, in female children, in their relation to utero-gestation. The muscles are weak and flabby, and the children, though sometimes fat, are more commonly thin and wasted. Owing to the softness of the shafts of the long bones, and the enlargement of their extremities, they are prone to deformity and to have a clumsy aspect; so that "bow-legs" and "knock-knees" are common.

Amongst other symptoms the child shows a great disinclination to walk, is feeble on its legs, and complains of a "diffuse soreness of body," so that it dislikes to be moved.

Profuse sweating, especially about the head, is common, and some children have a tendency to roll the head about, and so rub off the hair over the occiput. There is often slight fever with nocturnal restlessness, and a tendency to throw off the bed-coverings. The skin has usually a coarse, muddy aspect, and the superficial veins are unduly prominent. The child is pale, peevish, and fretful.

We have already mentioned the frequency with which diarrhœa is found preceding or accompanying rickets. The motions are usually unhealthy in colour and aspect, and very offensive.

Imperfect nutrition of the nervous centres causes mental backwardness, and marked *nervous* symptoms are common, such as *laryngismus stridulus*, *convulsions*, and *tetany*.

Rickets are believed by many to bear a causal relation to certain other diseases commonly observed in childhood, such as broncho-pneumonia, pulmonary collapse, asthma, epilepsy, and chorea.

This brief and imperfect sketch of the general features of this disease will suffice to introduce us to the consideration of its appropriate treatment.

The *indications* for **treatment** are preventive and remedial. Whatever remedies we may employ, it is important that in so chronic a disease as rickets they should be maintained for a length of time.

We must endeavour to remove both the parent and the child from the influence of those insanitary conditions and habits of life which we have seen to be influential in causing this disease. We must also apply to the symptoms which attend the developed disease such remedial measures as common-sense and experience have shown to be useful. The treatment of rickets resolves itself mainly into dietetic and hygienic measures. A mother who has previously borne rickety children should, during utero-gestation and lactation, be suitably fed. Care should be taken that an adequate amount of animal proteids, fats, and lime salts enters into her daily dietary. Rapidly repeated pregnancies and suckling during pregnancy should be avoided.

Since rickets is seldom seen in breast-fed children, we must endeavour to see that the child is fed at the breast. But this is not all; we must see that no improper food is allowed in addition to the milk. If there is reason to think the mother's milk defective in quality or in amount, it is preferable to supplement it for a while with some appropriate modification of cow's milk, rather than to cease suckling altogether. After weaning, good cow's milk should be the staple food; our addition should in the first instance be in the direction of proteids, and later of carbohydrates, and with great caution.

In hand-fed children it is most important also to see that they are not brought up on foods consisting chiefly of carbohydrates, as is so commonly the case with the poor. The milk they get should be good in quality and sufficient in quantity, and should contain its full proportion of cream, or even more than this. If the amount of milk given is too little, it may contain the full percentage of fat, and yet not supply the total fat need. If cow's milk has to be diluted, cream must always be added to make up for the deficiency of fat. With the poorer classes, who cannot afford the addition of cream, we are compelled to supply the necessary fat in the medicinal form of doses of cod-liver oil. Some children cannot digest cow's milk in any dilution on account of the casein it contains. These will receive either peptonised milk or whey with a due proportion of cream. In winter a little cod-liver oil, made into an emulsion with lime water and sweetened with milk sugar, is an excellent addition. Each teaspoonful should contain about 10 to 15 minims of the oil, and we must see that it does not disagree with the child's stomach. Malt extract may by its diastasic properties aid in the digestion of starch. *Raw meat juice* is a most valuable addition to the diet, as it is rich in salts. A little phosphate of lime may be added to the milk taken. *Raw meat pulp* has also been administered with great advantage in these cases, even up to 2 ounces daily, according to the age of the child. For older children milk puddings are suitable made with "entire wheat flour."

In older children sandwiches of raw meat pulp, meat juices and broths, eggs beaten up with milk or lightly boiled, and the juice of fresh fruits may be added to the diet from time to time. We must not *overdo* the giving of fat, nor make too sudden changes in the child's diet, as digestive disturbances are easily set up.

Fresh air and plenty of sunshine in a healthy country district or at the seaside, and removal from close, dark, overcrowded city dwellings, are of the greatest importance. Good ventilation of sleeping and dwelling apartments should be seen to. The air of the seaside will be found of special value in many cases.

Bathing or sponging with tepid water night and morning is useful; the child should be dried quickly, and careful friction with the hand applied.

Children who suffer from this disease are very sensitive to chill and apt to fall victims to broncho-pneumonia, pulmonary collapse, etc., and they must therefore be warmly clad in well-fitting woollen clothing, and a flannel band should be worn round the abdomen. But the garments must fit easily, so as not to hamper the respiratory movements or those of the limbs. Bronchitis may be induced by the presence of adenoids, the growth of which seems to be encouraged by rickets. In this case we must at the first favourable opportunity see that the obstruction to free respiration is removed.

We should endeavour to prevent or correct deformities by improving the nutrition and tone of the muscles, in which gentle massage and frictions will be of much service. The limbs can be thus drawn into their natural positions and deformity guarded against until diet and medicinal means have strengthened the bones, muscles, and ligaments. We must protect the pliable bones from the weight of the body, from muscular action and external forces. When there is marked kyphosis, the child should not be allowed to sit up, and should be taken out of doors lying in a spinal carriage. In some cases it is necessary to apply splints which project beyond the feet, so as entirely to prevent locomotion. Surgical measures may be needed in certain cases to correct permanent deformities.

There is but little scope for drug treatment in this disease beyond that already mentioned. Phosphorus has been recommended in various forms, but there is no evidence of its efficacy. When there is diarrhœa, such as we have already referred to, it is of the utmost importance that it should be checked, as it seriously affects the nutrition of the child. A combination of carbonate of lime and salicylate of bismuth (as an intestinal antiseptic) in doses suitable to the age of the child will be the best remedy, together with an occasional dose of grey powder.

Some preparations of iron, such as the syrup of iodide or the citrate of iron and ammonia, will be needed in markedly anæmic cases. Arsenic also is employed with advantage for the same purpose. A combination of syrup of iodide of iron with small doses of cod-liver oil is a good prescription. Jacobi and others have recommended phosphorus, $\frac{1}{120}$ grain, dissolved in olive oil, twice or thrice daily.

For the nervous complications sedatives may sometimes be needed, such as 2 or 3 grains of sodium bromide with a grain of chloral until the urgent symptoms are relieved; for their ultimate cure we must trust to a well-ordered diet along with general hygienic measures.

SCURVY OR SCORBUTUS

Scurvy arises, like rickets, from a defective and unsuitable dietary. It has been defined as a constitutional disease characterised by anæmia, great loss of strength, a spongy condition of the gums, and a tendency to hæmorrhages.

This disease was at one time very prevalent amongst armies in the field and sailors, and was attributed to the difficulty in providing them with fresh animal and vegetable food. Since prophylactic measures have been adopted it has been practically abolished in the naval service.

With regard to the causation of scurvy, there is overwhelming evidence to show that in the great majority of cases the determining cause is a lack of fresh vegetable food. Scurvy has undoubtedly occurred when smoked and salted meat and fish have been substituted for a long period of time for fresh meat, even when lime juice has been allowed. Again, in the Boer concentration camps, in which the diet was variable, if not varied, and the only constant factor was dirt, scurvy was rife. So that we must either look for some common fault in all these conditions, or admit that other causes than deprivation of fresh vegetable food are at times responsible for, or contributory to, the occurrence of scurvy.

To Garrod is due the credit of having shown that potash salts were deficient in the blood in scurvy, and from this he argued that scurvy was due to lack of fresh vegetables, owing to their richness in organic potash salts. Ralfe carried Garrod's observations a stage farther, and showed that the absence of potash salts was material, in so far as they were of a kind that served to maintain the alkalinity of the blood—in fact, he referred scurvy to diminished alkalinity of the blood. Wright's investigations serve to corroborate Ralfe. He maintains that the types of diet that induce scurvy are those in which there is an excess of mineral acids over bases, *i.e.* too much meat and cereals, and too little fresh vegetable. He also found that the alkalinity of the blood was diminished during an attack, but rose again as the disease yielded to treatment. On these grounds Wright considers scurvy an acidosis or acid intoxication. It is not, however, a simple unmixed condition of diminished alkalinity; if it were so, artificial potash salts should be as curative as the potash salts of fresh vegetables.

For some time various observers have sought to refer scurvy to a microbial origin; but in this direction only the work of Babes * calls for serious consideration. He isolated a bacillus from the gums, but not from the blood, of several cases of scurvy, which when inoculated into rabbits produced the affection of the gums and the hæmorrhages characteristic of scurvy. If microbial infection does play some part in the production of certain of the symptoms it is probably grafted on to a pre-existing constitutional cachexia.

No doubt other factors, moral and physical, besides improper food, contribute to the production of this disease, such as overcrowding, confinement in cold, damp quarters, prolonged fatigue under depressing influences, and mental depression; this last factor will account for its tendency to occur amongst prisoners. Nansen's expedition served to show that with sufficient care bestowed on the comfort of the men, and with a varied stock of carefully prepared food, scurvy may be kept at bay for an unlimited length of time. He took large quantities of potatoes, vegetables and fruit, dried and preserved in hermetically sealed tins, and abundant lime juice. The supply of meat was generous—not smoked or salt meat, but fresh meat either desiccated or sterilised by heat. Variety was the keynote of the diet, and, aided by healthy and cheerful surroundings, proved an effectual preventive.

The clinical features of scurvy are dependent on the altered condition of the blood, which leads to hæmorrhages in various parts of the body—especially subcutaneous and intermuscular—and to the grave anæmia attending these changes.

The earliest symptoms are progressive debility,

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* *Deutsch med. Woch.*, 1893, No. 43.

lack of energy, mental and physical, and notable pallor. The complexion becomes sallow and unhealthy, and there is complaint usually of pain in the back and limbs. Then there is *stomatitis*, with spongy, swollen gums, which bleed readily. The tongue is coated and swollen. The teeth become loose and may actually fall out; even the jaw may, in some instances, become necrosed. The breath is very fœtid. Hæmorrhage beneath the buccal mucous membrane is often seen.

The skin is dry and rough and a purpuric rash (ecchymoses) appears first on the lower limbs and then on the arms and trunk, the petechiæ being confined mostly to the region of the hair follicles; when there is subcutaneous hæmorrhage we may find irregular, swollen, purplish patches in various parts of the body, but especially over the thighs and buttocks. Nodes may appear on the legs from effusions between the bones and the periosteum. Hæmorrhage between the muscles and beneath the fasciæ may lead to brawny swellings in the calves. The slightest bruise or injury will cause ecchymosis. Epistaxis is frequent, and in severe cases hæmaturia and bleeding from the bowel may occur. Constipation is a common symptom. A subacute arthritis is not infrequent, with much tenderness over the joints and sometimes effusion into them, especially the knees and ankles.

Accompanying these manifestations there are the symptoms of profound anæmia, great feebleness, cardiac palpitations and dyspnœa, and the usual microscopic changes in the blood. Grave complications often arise. Night blindness is simply due to retinal exhaustion from anæmia and malnutrition. Cerebral and meningeal hæmorrhage may cause paralysis, convulsions, and coma. Infective pneumonia and pulmonary gangrene may arise from the inhalation of septic matters from the mouth. Hæmorrhagic pleurisy and pericarditis occasionally occur. Diarrhœa and dysentery are occasional complications. But it is exceptional nowadays to encounter these grave complications, as suitable treatment early applied usually leads to complete, though slow, recovery.

The **indications for treatment** are to restore the blood to a healthy normal state by appropriate food and to relieve the symptoms that arise in the course of the disease, as the stomatitis, anæmia, etc.

There is also the prophylactic indication, viz. to take suitable measures to prevent the onset of the disease in those exposed to it by their calling. Sailors who are bound for long voyages, soldiers on active service, and prisoners are those more especially liable to suffer from scurvy from the lack of fresh animal and vegetable foods. In the case of sailors, in most instances the outbreak of the disease can be prevented by the issue of a daily ration of such antiscorbutic substances as lemon or lime juice, sugar, and vinegar. We have already dwelt on the importance of healthy, comfortable, and cheerful surroundings.

The law in the United States applying to seamen requires that after salt provisions, mainly, have been served out to the crew for ten days, and as long afterwards as such consumption of salt provisions continues, half an ounce of lime or lemon juice and half an ounce of sugar shall be served out to each member of the crew daily, and half a pint of vinegar per week. Whenever in port, great care should be taken to secure rations of fresh meat, with fresh vegetables and fruit. Dried and canned fruit and vegetables as well as pickles are good substitutes for the fresh articles, and are especially useful to vary the monotony of the food. It has been stated, on the testimony of many explorers, that *raw* meat has proved a preventive of scurvy when *cooked* meat has not.

Curative measures also are mainly dietetic. It must be remembered that when the patient first comes under treatment, his digestion may be very feeble, and the state of the mouth and gums will quite disable him from taking solid food. Vegetable soups and purées, the pulp of fruits, the juice of lemons or limes, and scraped raw meat, should be given at first and in small quantities at a time, until some restoration of digestive power is obtained. Spinach and other green vegetables, red-cabbage, pickles, lettuce, watercress, sorrel, are useful, and these may be mixed advantageously with mashed potatoes or pea or lentil meal. But fresh meat, perhaps because of the lactates it contains, and fresh milk, because of its small amount of citrates, and eggs are also antiscorbutic, and when procurable should be added to the preceding foods; and indeed, in some cases, either from the distaste of the patient or for other reasons, they may have to take their place. A due amount of fresh animal food is needed to overcome the extreme anæmia often met with in these cases; raw meat juice and scraped raw meat are excellent for such patients. Small quantities of scraped meat may be mixed with milk and given frequently when the stomach is much disordered, together with full doses of lime juice. It is stated that Liebig's extract of meat is antiscorbutic on account of its large proportion of potash salts. A good supply of drinking water is of the utmost importance. At sea it must be distilled from salt water. Tea, cocoa, coffee, wine, beer and cider all have some influence for good, however slight.

Antiseptic and astringent mouth washes will be needed for the spongy and bleeding gums. Tincture of krameria and alum make a useful astringent mouth wash, half an ounce of the former and a dram of the latter to 8 ounces of water. Another good mouth wash may be made with potassium chlorate 1 dram, and tincture of myrrh 2 drams, to half a pint of water. These may be warmed and used frequently, and especially after taking food. Dilute carbolic lotion and Condy's fluid have also been used as antiseptic mouth washes. In some cases it has been found necessary to paint the gums with a strong solution of nitrate of silver; adrenalin chloride 1 : 1000 diluted with four parts of water may be used, if there is persistent oozing. For constipation either large enemata should be used or such gentle saline aperients as sodium sulphate or phosphate. If diarrhœa should exist it may be controlled by a mixture of bismuth with chalk and tincture of catechu. The continued use of such tonics as quinine and iron and strychnine will be needed during convalescence.

In cases of profound anæmia, the subcutaneous injection of normal saline solution has been found beneficial. Warm baths, together with gentle massage and passive movements, will help to restore the stiffened joints to their normal mobility. Gentle friction over the ecchymoses of the legs and also over the deeper situated hæmatomata may promote their absorption.

INFANTILE SCURVY

Infantile scurvy is a form of scurvy that is occasionally met with in infants about the end of the first year of life. It was formerly known as "acute rickets" and as "scurvy rickets." Its relation to rickets is defined in the title of the paper by which Barlow * obtained general recognition of the disease: "On cases described as acute rickets, which are probably a combination of scurvy and rickets, the scurvy being an essential and the rickets a variable element." The disease has been traced to deprivation of fresh milk, and the substitution for it as a rule of condensed milk, fortified by the addition of some artificial infant's food. There is no question that in exceptional instances the use of both sterilised and boiled milk, with or without the addition of an artificial food, has been the means of producing the disease. Probably the citrates of the milk are so altered in solubility that they are no longer absorbed. Hence we come back to the same essential fault as causes scurvy in the adult, viz. deficiency of organic salts in their natural combination, leading to diminished alkalinity of the blood. The symptoms are of the same general nature as in the adult, and along with a nutritional cachexia depend on the same tendency to hæmorrhages in various parts. The gums are not affected, however, unless teeth have been already cut. The indications for treatment are the same as in the adult, subject to the modifications of diet suitable to infancy. Any artificial food must be stopped at once, and replaced by fresh unboiled, unsterilised milk. A judicious mixture or alternation of potato-pulp, fresh milk, and raw meat juice will generally be found useful and acceptable to the child. A fine potato gruel may be made in the following manner: Rub some steamed floury potato (or a potato baked in its jacket) through a fine sieve, beat it up well with milk till smooth and of the consistency of thin cream. A teaspoonful of this may be added to each bottle of food at first, and gradually increased to a dessertspoonful. Well-boiled carrots may be treated in the same way; or freshly made beef tea or chicken broth may be used instead of milk. It is important to remember that peptonising milk seems to impair its antiscorbutic property. The child should at the same time be given a teaspoonful of grape or orange juice occasionally. Fresh meat juice expressed from rump steak quickly warmed through, just enough to start its juices, is also very serviceable. The organic salts of potash—the tartrate or the citrate—are prescribed by some; it is difficult to determine, in face of the modified diet, whether any beneficial influence can be rightly attributed to them. They may be combined with a few grains of the ammonio-citrate of iron, or the citrate of iron and quinine, to remove anæmia.

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* *Transac. Royal Med. and Chirurg. Soc.*, 1883.

ADDITIONAL FORMULÆ

For rickets

℞ Ferri carbonatis saccharati
Ferri lactatis } āā ʒjss.
Calcii phosphatis
Sacchari lactis

M. f. pulv. Ten to twenty grains daily. (*Billroth.*)

For the same

℞ Phosphori, gr. $\frac{1}{6}$.
Solve in
Olei amygdalæ dulcis, ʒiij.
et adde
Pulv. g. acaciæ, ʒj.
Syrupi simplicis, ʒjss.
Aquæ destillatæ, ℥ijss.

M. f. mistura. One to four teaspoonfuls daily.
(*Billroth.*)

For the same

℞ Olei morrhuæ, ʒss.
Syrupi calcis lactophosphatis } āā ♏xv.
Liquoris calcis

M. f. dosis. To be taken three times a day—for a child one year old.
(*J. Lewis Smith.*)

For the diarrhœa of rickets

℞ Olei ricini, ♏v.
Mucilaginis tragacanthæ, ♏xv.
Syrupi, ʒss.
Aquæ menthæ piperitæ ad ʒj.

M. f. dosis. To be taken three times a day—for a child one year old. (*Angel Money.*)

For infantile scurvy

℞ Liquoris arsenicalis, ♏j.
Vini ferri, ʒss.

M. f. dosis. To be taken three times a day with or without 10 to 20 minims of cod-liver oil—for a child one year old. (*Muskett.*)

Mouth wash for spongy and bleeding gums

℞ Glycerini acidi carbolici } āā ♏xv.
Glycerini acidi tannici
Aquæ ad ℥j.
M. f. lotio. (*Cheadle.*)

Thymus gland in rickets

Founded on the statement that the thymus gland is functionally associated with the proper development and growth of bone. *Mendel* suggests that the symptoms of rickets may be due to a disturbance of the functions of that gland. He has, in consequence, treated over 100 cases with thymus, using, latterly, tabloids of gland substances. He states that all the symptoms gradually diminished and eventually disappeared. The treatment had usually to be continued for some months.
(*Brit. Med. Journal* Epitome, March 8th, 1902.)

PART IX.—SPECIFIC INFECTIVE DISEASES

CHAPTER I

TREATMENT OF ACUTE RHEUMATISM

Nature and Characters of the Disease—An Acute Infective Disease with local Manifestations—Symptoms—Etiology—Pathology—Rheumatic Hyperpyrexia—Subacute Cases—*Indications for Treatment*—Rest—Diet—Alkaline Drinks, with Milk—Local Applications—Blisters, etc.—Serum Treatment—*Salicylates and Salicin*—Toxic Symptoms from Salicylates—Importance of Purity of Drug—Choice of Preparations—Doses—Salophen—Aspirin—*Methyl Salicylate*—Sodium Benzoate—Opium—*Alkalies*—A Combination of Alkalies and Salicylates—Free Consumption of Pure Water—Quinine—Potassium Iodide in Subacute Cases—Treatment of Hyperpyrexia—Cold Baths—Treatment of Convalescence. Additional Formulæ.

Acute rheumatism is a disease of very frequent occurrence in England: typically it is characterised by fever and by the occurrence of inflammation in certain of the synovial membranes, with a tendency to attack the endocardium, and less frequently one or other of the serous membranes.

The synovial membranes of the joints of the *extremities* are those usually attacked, and the pericardium (next to the endocardium) is the most frequently affected of the serous membranes. The pleura is, however, more frequently affected than is generally recognised, and in rare instances the peritoneum does not escape. It is interesting to note this predilection of the inflammation for parts of related, if not identical, structure and functions. The serous membranes and the endocardium not only resemble the synovial membranes in structure, but they also subserve an analogous purpose, that of facilitating the functional movements of internal organs.

In the great majority of cases, the joint affection does not involve any anatomical changes, beyond inflammatory hyperæmia of the synovial membrane, and effusion of fluid into the joint, and this is consistent with the manner in which the inflammation will quickly subside in one set of joints and attack others. The joints, though swollen and very painful, are only faintly, if at all red; and the patient's sufferings depend greatly on the number of the joints involved. In *subacute* cases the joint affection may be slight, and the pains also; and in some instances, especially in children, there may be endocarditis, myocarditis, and pericarditis without any notable joint inflammation.

The knees are the joints most frequently affected, the shoulders and ankles next, then the wrists and hands and the elbows. It rarely attacks the hips, and still more rarely the toes, and in the other joints of the body it is scarcely known. Acute rheumatism is also peculiar, as has already been remarked, in its tendency to move rapidly from one set of joints to another.

A remarkable observation of Graves, bearing on the pathological nature of this disease, was that the fever may occur alone, without any joint affection; and another important fact is that the pericardium or the endocardium, or one or other pleura, may, for a time, be the only membrane affected. In children the heart is almost always involved, sometimes very severely, while the arthritis may be insignificant.

In acute cases of average severity the temperature usually ranges between 102° and 104° F. early in the disease, from the second to the fourth day. In *subacute* cases it may be between 100° and 102°. The pulse is rapid, the tongue coated with a thick white fur, the skin often bathed with sour-smelling perspiration; and connected with this great loss of water from the surface there is great thirst (with loss of appetite), and the *urine* is scanty, high-coloured, dense, deficient in chlorides, and deposits an abundance of lithates.

The tendency to the development of endocarditis, myocarditis, and pericarditis in the course of this disease is an important point to bear in mind; and we should also remember that these complications are more liable to occur the younger the patient is. The pleura also is often involved, though this is frequently overlooked.*

Dilatation of the heart and subsequent inflammation of the endocardium are so frequently features of the disease, as seen in children, that they may almost be regarded as part of the disease, rather than as a complication. The early and marked involvement of the myocardium is the logical consequence of an infection that comes by way of the coronary arteries.

Sudamina and erythematous and other skin eruptions are common. Subcutaneous, so-called "rheumatic *nodules*" are often seen in children, and are seldom seen without infection of the heart. Lees thinks they point to an intensity of the rheumatic process. Tonsillitis is a frequent initial symptom, and it is thought that the infective agent often gains entrance to the blood through the tonsils.

With regard to the **causation** of acute rheumatism, it is apt to be set down, without sufficiently careful inquiry, to exposure to cold and wet, and this may be the case in a certain number of instances, but in very many patients no such exposure can be discovered. American writers consider the season of spring favourable to the occurrence of acute rheumatism, and to some extent this is the case in Great Britain. Over-exertion and muscular fatigue, as well as or combined with exposure to chill, are also regarded as causes; but it is probable that these depressing conditions simply produce a loss of the normal power of resistance to the exciting cause of this, as of other, acute infective diseases. An *inherited* constitutional proneness to the disease exists, and a history of rheumatism in one or both parents is found in no less than one-fourth of all cases of rheumatic fever. Childhood and youth are predisposing causes. The greatest number of cases appear to occur between the ages of ten and twenty.

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* Lebert found pleurisy in 10 per cent. of his cases.

As to the *true* nature of acute rheumatism, the *lactic acid* theory, which referred this disease to the accumulation of that substance in the blood, has now few adherents; the *nervous* theory, which attributed it to trophic nerve disturbances resulting from chill, is no longer seriously advanced; while the latest view, that it is a microbic infection, is almost universally accepted.

In support of the last hypothesis the analogy is urged between the phenomena of acute rheumatism and those of pyæmia, septicæmia, scarlet fever, and other infective diseases; the arthritis, the fever, the sweatings, the tendency to cutaneous eruptions, the rapidly developed anæmia, the leucocytosis, the tendency to the involvement of the endocardium and the serous membranes, the relapses, and the almost specific action of the salicylates on the articular inflammation, all combine to present "the very type of an acute infection."

Various organisms have been isolated by different observers from the tissues and body fluids both before and after death, but not one of them satisfies the strict tests of "specific" character. In this country the diplococcus described by Paine and Poynton, among others, has been widely accepted as the specific cause. But the failure of so many other competent investigators to isolate it in cases of acute rheumatism, and the fact that the experimental lesions it produces in the heart and joints are identical with those produced by other septic organisms, admittedly not specific, has led most bacteriologists to regard it as an inconstant and accidental association of the disease. The multiplicity of the manifestations of acute rheumatism in childhood lends some colour to the view that a variety of organisms may be causally connected with the disease, but on the other hand the comparative uniformity of the symptoms in the adult, within narrow limits of variability, rather suggests that the disease is a clinical entity, due to a specific micro-organism.

We may therefore conclude that acute rheumatism should be regarded as an infective fever, having as its most important feature a toxic action on the heart, especially virulent in children, with those other clinical manifestations already mentioned.

The great liability to **relapses** must be borne in mind in the management of these cases.

Apart from the consequences of the cardiac lesions it may induce, and the occasional, but rare, occurrence of rheumatic hyperpyrexia, this disease in adults is scarcely ever fatal.

A few words must be said relative to the occurrence of **hyperpyrexia** before we pass on to the main part of our business, viz. the discussion of the treatment of this malady.

Occasionally, in apparently favourable cases, hyperpyrexia may suddenly supervene, the temperature rising as high as 109° to 110°, or even higher, and with this rise of temperature certain *cerebral* symptoms usually appear, convulsions, or violent delirium, or drowsiness, and, finally, coma. French authors term these cases, cases of *cerebral rheumatism*, but hyperpyrexia may occur, and the temperature rise to 108°, or even to 110°, without cerebral symptoms. The pulse is fast and feeble, and there is extreme prostration. Warning symptoms of the approach of this complication are a cessation of the sweatings, a disappearance of the pains, and a restoration of the mobility of the joints.

The **subacute** cases are often excessively tedious, and of very slow progress, and much less amenable to treatment than the acute forms. A subfebrile temperature, about 99° or 100°, will continue with but slight fluctuations, and with an occasional rise to 101° or 102°, for many weeks. These are, perhaps, amongst the most tedious cases we see in the hospital wards.

Acute rheumatism, when left to follow a *natural* course, untreated, is apt to be prolonged and tedious; and we may claim to have made some advance in its treatment since the days of that physician, quoted by Sir T. Watson, who, when asked what was good for acute rheumatism, answered, "Six weeks!"

In the absence of any definite *causal indication*, we may formulate the following general and symptomatic **indications** for the **treatment** of this affection:

(1) To lessen the local articular inflammation and severe pain by rest and pain-relieving remedies.

(2) To modify and change, if possible, the morbid state of the blood and other fluids.

(3) To protect the heart, so far as we possibly can, from serious and permanent injury.

(4) To take suitable measures to immediately reduce *hyperpyrexia* should it arise.

(5) To guard against the tendency to relapses by careful and prolonged supervision during convalescence.

The first indication will be promoted by ordering the patient absolute rest in bed at the earliest appearance of the symptoms. There will be no difficulty in enforcing this in the severe or average case; but in subacute cases, without much joint inflammation or pain, it may not be so easy; and then we may have to point out to the patient the serious risk he runs of bringing on cardiac complications by the neglect of this indication.

As the patient will have to remain in bed probably for many weeks, and for some days, at least, will suffer from profuse perspiration, it is most important, for his comfort, that the bed should be well arranged.

A feather-bed is obviously unsuitable ; a soft hair-bed, on a good spring mattress, is the best. It is not necessary that he should lie *between* blankets, as is often suggested, as this proves very heating and uncomfortable to many ; but he should lie *on* a soft, thin blanket, and be covered by a cotton sheet. This will be all that is necessary in order to prevent unpleasantness from the profuse perspiration. He should have a loosely-fitting night-dress of soft, thin flannel, with frequent changes, as this dress becomes quickly saturated with the sour-smelling perspiration ; and it is a good plan, in order to facilitate examination and dressings, for the night-dress to open down the whole length in front, and very freely on the outside of the sleeves ; a light flannel cape may be worn over the shoulders. When the joints of the lower limbs are very painful and swollen, the weight of the bed-clothes may be kept off by a low cradle. The patient must not be allowed, even if he wishes, to get out of bed to evacuate either bowels or bladder. The room should be kept fresh and airy, but free from draughts. Before giving any food a dose of calomel should be administered to clear the bowel.

The **diet**, while the fever and joint inflammation are present, should be of the lightest possible kind, cooling, and entirely fluid. A pint of milk diluted with a pint of boiled water, and containing 30 or 40 grains of sodium bicarbonate and 10 to 20 grains of common salt, cooled by a lump of ice, should be kept in a jug near the patient, and a tumblerful given him frequently. He may take in this way 3 to 4 pints of milk * in the twenty-four hours. Another jug should contain a decoction of lemons, made by roughly tearing a lemon to pieces and boiling it for ten minutes in a pint of water, and straining and then adding 20 to 30 grains of bicarbonate of potash, and some ice to cool it. This may be freely drunk in the intervals between the milk. The free consumption of these pleasant alkaline and cooling drinks answers the important indication of altering and improving the blood condition by diluting noxious substances in it, promoting their elimination, and supplying the great loss of water that is taking place by the skin, as well as of maintaining the due alkalinity of the fluids. Skim-milk, buttermilk, or whey may be taken instead of milk if the latter should by chance disagree, which it is most unlikely to do, if given in the manner we have suggested. If the patient drinks three jugs of the milk and water prepared as directed, and three jugs of the lemon drink in twenty-four hours, he will have taken at least 90 grains of sodium bicarbonate and 60 grains of potassium bicarbonate (much of the latter converted into citrate) dissolved in a large quantity of water—about 150 ounces. It will also be seen later on that we propose that some of this fluid should be the vehicle for the administration of his medicines. This quantity of fluid is not excessive, considering the loss by the skin in the acute stage. As soon as the urine becomes pale and gives an alkaline reaction, the amount of alkali in these drinks must be diminished. Thin oatmeal gruel and barley water also are permissible, but all meat extracts are particularly counter-indicated in the febrile stage and when the urine is dense and high-coloured and the excretory activity of the kidneys impaired. A cup of weak tea may be taken now and then if desired; or the juice of an orange may be allowed. After the febrile stage, light clear soups and broths may be given, flavoured with vegetables and savoury herbs. A little pounded beef or chicken and some crumb of stale bread may be mixed with the soups; light farinaceous puddings, bread and milk, and such foods are also suitable. All alcoholic beverages are to be avoided, save in quite exceptional cases. In unduly protracted cases some forms of light animal nourishment may have to be given, although the temperature may still be febrile. We prefer pounded meat added to light broth rather than strong beef extracts. Some supporting food of this kind should be introduced into the diet as early as possible to counteract the tendency to anæmia.

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* Biot, of Lyons, has found a milk diet of itself an excellent remedy in acute rheumatism, relieving the pain and lowering the temperature. He considers it acts by stimulating the renal functions. The combination we have advised above will frequently be found to exert a remarkable diuretic effect.

Besides absolute rest for the inflamed joints (which may sometimes be promoted by the adaptation to the limb of splints, composed of thick wrappings of cotton-wool), some form of *local* treatment for the purpose of relieving pain and reducing inflammation is usual, and often beneficial.

As a rule free wrapping of the affected joints in cotton-wool is all that is needed; when the knees or ankles are involved, a cradle may be used to support the weight of the clothes.

When there is much pain in the joints, perhaps the best application is a lotion composed of one part of laudanum to six parts of hot water, with about 20 grains of sodium bicarbonate to the ounce; strips of lint or of soft linen are dipped in this lotion and applied to the joint, which is then enveloped in absorbent cotton-wool retained by a light flannel bandage. Ichthyol ointment has been recommended to be rubbed into the joints, and may be applied with benefit in the more protracted subacute cases.* The local application of oil of wintergreen (methyl salicylate) is at times useful. About 30 to 40 drops are applied to the surface of the painful joints with a paint-brush, and allowed to dry: no covering should be employed. Or methyl salicylate diluted with an equal quantity of olive oil may be lightly rubbed into the part; excessive friction or subsequent wrapping is apt to induce local irritation. If the penetrating odour of the salicylate is objected to, it may be replaced by *mesotan*, in the same dilution. As our object is quite as much to get the salicylate into the general circulation as to obtain any immediate local effect, we may also apply these remedies to parts other than the painful joints—for example, to the forearms and arms, where the skin is comparatively thin and absorbs readily.

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* Other local applications will be found amongst the formulæ at the end of this chapter.

The application of **blisters** to the joints has, from time to time, received warm approval, although at present it is but rarely adopted, probably because our general remedies prove so much more efficacious in relieving the joint affections than used to be the case. Blisters may be applied either after the manner recommended by the late Dr. Herbert Davies, who applied the blisters *directly* to the inflamed joints, as for instance, 3 inches of cantharides plaster *around* the knee, a plan adopted also by Fräntzel in Berlin; or according to the plan of Lasègue, of Paris, which we think preferable—namely, to apply a strip of blistering plaster, 1½ to 2 inches wide, an inch or two above and below the inflamed joint. We still adopt this method, and often with great advantage, in the somewhat protracted cases in which the joint affection does not readily yield to treatment with salicylates. Most authorities admit that blistering the joints is attended with relief of pain and diminution of inflammation, but many contend that with our modern methods of treatment it is rarely needed, and that it has the decided disadvantage of tending to cause renal and vesical irritation. It has never been our lot to see either renal or vesical irritation produced by blisters, and we believe it rarely, if ever, occurs, except from their improper use and unskilful application.

Very rarely some degree of pain and swelling persists in one or more of the joints for some time after all constitutional symptoms have disappeared. This indolent condition yields readily to douche-massage, when that is available. Failing this, we must be content with simple massage and *passive* movements, along with the internal administration of iodide of potassium.

We now pass on to the consideration of the **general internal medicinal treatment** of acute rheumatism.

Menzer prepared an **antiserum** from streptococci isolated from the throats of patients with rheumatic angina. The good results he claims* from its use were purchased at the expense of severe symptoms of reaction in the heart and joints, and have not been obtained by other observers. It is obviously futile to prepare antisera, until we have established the identity of the causal organism.

We will next consider the treatment by **salicylates** and **salicin**, a method which has certainly proved more efficacious than any other that has ever been advocated in the treatment of this disease. The first to use salicylic acid in acute rheumatism was Buss, of Basle, in 1875; then Stricker in Traube's clinic employed it, and published some of his results in January, 1876; and in the same year Maclagan published some cases he had treated with salicin. In 1877 Germain Sée advocated the use of sodium salicylate, and this salt rapidly displaced salicylic acid and salicin. Since then the salicylates have gradually and steadily gained in favour, and may now be said to be almost universally adopted.

One of the first and most notable effects of the salicylate treatment is the subsidence of articular pain and swelling. Usually in twenty-four hours considerable relief is experienced, and both pain and swelling will often completely disappear within three to five days. At the same time there is generally a steady and rapid fall of temperature, and the patient may be quite free from fever in from three to six days.

With regard to the influence of this treatment on cardiac complications: since in very many instances of treatment by salicylates the acute phase is practically over in less than three days, most physicians fully recognise the *indirect* influence of the salicylates in protecting the heart from injury, as it diminishes greatly the total duration of the acute and active period of the disease ; and even when a cardiac complication has already been excited, the salicylates, by increasing the activity of the skin, by dilating the peripheral vessels, and perhaps by a direct depressant action on the muscle of the over-acting heart, and by relieving pyrexia, may tend to prevent the advance and to diminish the intensity of the endocarditis, and so lessen the gravity of the lesion ; but the effect produced on the process in the heart is by no means comparable to that seen in the case of the joints.

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* *Münch. med. Woch.*, August 16, 1901.

We have not found that relapses are more frequent, as has been stated, after the salicylates than after other methods of treatment, especially if the treatment is maintained, as it should be, in a modified form, for at least a fortnight after the cessation of the primary acute attack.

There are some cases in which we find an intolerance of salicylates, just as in other persons we find an intolerance of quinine, and then certain disagreeable characteristic symptoms become developed. Nausea, epigastric pain, and vomiting are sometimes produced ; great cardiac depression with slowness of pulse has often been observed after long-continued full doses ; giddiness, dimness of vision, deafness, and buzzing in the ears and headache are sometimes complained of, and even delirium has been observed. In some instances a condition closely resembling the air-hunger of diabetes is seen, and is probably due to a direct toxic action on the respiratory centre. An erythematous eruption on the skin has occasionally been noted, and also epistaxis and hæmaturia. The question has arisen whether these toxic symptoms are not sometimes due to **impurities** in the salicylic acid, and it has been maintained that they are far more liable to occur with the artificial than the natural acid. Professor Charteris isolated a substance from the artificial acid and its soda compound, which he was able to prove to be the cause of the toxic symptoms observed in many cases, and he suggested a method for their purification. Great care should always be used in seeing that a pure preparation is dispensed. Either the "*natural*" or the "physiologically pure" salt should always be prescribed.

Women seem more susceptible to these toxic effects than men, while children bear salicylates remarkably well. Dujardin-Beaumetz pointed out that it was important to ascertain if these preparations were freely eliminated by the kidneys, for if this is not the case, owing to the existence of chronic renal disease, dangerous symptoms may arise.

Next, with regard to the best manner of administering the salicyl compounds and the doses necessary.

We may make use of either salicylic acid, or sodium salicylate, or salicin. The acid is the least desirable form, as it is very slightly soluble in cold water, and it is never desirable to give medicines in the form of insoluble powders when we can substitute a soluble salt of equal efficacy. It may, however, be dissolved by mixing it with a solution of acetate of ammonia or citrate of potash; about 40 grains of citrate of potash will dissolve 20 grains of salicylic acid in an ounce of water; but in this case decomposition takes place and potassium salicylate is formed. There is no objection whatever to this, especially if we desire to give some potassium salt with the salicylate. Salicylic acid may then be given dissolved in this manner, or sodium salicylate may be used instead, as is generally done. The dose of either is from 5 to 30 grains, according to the age of the patient and the severity of the attack, given at first every two hours. In an adult, if the attack is not a severe one, we may begin with 10-grain doses; if the attack is severe and the temperature high, it will be advisable to begin with doses of 15 or 20 grains or even more. If on the second day the pain and fever show no very distinct signs of abatement, we must increase the quantity given, and as much as

3 or 4 drams may be given in twenty-four hours; this may be given either every two (15 to 20 grains) or three hours (20 to 30 grains).

If such doses produce no beneficial effect, it is advisable to discontinue the drug, as inapplicable to the particular case under treatment, and fall back on a combination of alkalies with quinine. We must be prepared, from time to time, with salicylate as with nearly every other drug, to find particular instances of insusceptibility to its action. When, however, this remedy has its usual and characteristic effect, when it relieves the pain and brings down the temperature, we should not continue the large doses, but reduce them gradually until the patient is taking about 45 or 60 grains daily, and in such doses *the remedy should be continued for a fortnight after the acute symptoms have subsided.* The sodium salt should be given freely diluted with water, and, as milk disguises its unpleasant taste, it may be administered mixed with a wineglassful of the milk-and-water beverage we have already recommended (p. 563). This will be found to simplify the nursing, as the medicine will thus be given together with a portion of the milk food.

Maclagan prefers *salicin* to the salicylates, and he gives it in large doses. The testimony of most other observers is that this drug has not so great an influence in reducing temperature or relieving pain as the salicylates, but it is certainly less depressing, and there is less risk with it of exciting toxic symptoms. We often give it in preference to the sodium salicylate, especially in mild cases, and in feeble, sensitive persons. It may be given, at first, in doses of 20 to 40 grains every two or three hours, and then, after it has subdued the acute symptoms, in smaller doses and less frequently. It is only sparingly soluble in cold water, and it is best, therefore, prescribed in powders combined with half as much potassium citrate and a few grains of sugar of milk. Each powder should be mixed with 2 or 3 ounces of warm milk and water.

Salophen, a tasteless crystalline substance composed of salicylic acid (51 per cent.) and *acetylparamidophenol*, has been recommended as a substitute for the salicylates in acute rheumatism. It is given in 15- or 20-grain doses in cachets, or in powder, washed down with water, thrice daily. It cannot be said to have established the claims originally made in its behalf.

Aspirin has received much commendation as a substitute for sodium salicylate. It is obtained by the action of acetic anhydride on salicylic acid. It is said to pass through the stomach unchanged and to set free nascent salicylic acid in the intestine. It is recommended to be given in 15-grain doses mixed with syrup and water; as much as 75 grains may be given in 24 hours. Its taste is less unpleasant than that of salicylate of sodium, and its effects are said to be as good, if not superior. It is stated to cause no gastric or intestinal trouble, nor any symptoms of collapse, to be non-irritative to the kidneys, and not attended with the toxic symptoms which occasionally arise with the sodium compound. We have obtained the opinion of several ward-sisters, who have had abundant opportunity of forming an impartial opinion as to the relative efficiency of aspirin and the salicylates of soda, from patients treated with the two drugs under otherwise identical conditions, and the verdict is strongly in favour of the sodium salt.

Salicylate of methyl, an artificial oil of wintergreen, has also been advocated as a substitute for sodium salicylate, and as a remedy for acute rheumatism, internally or applied externally. The natural oil of wintergreen has also been similarly prescribed. These preparations, however, are very unpleasant to take, and very inferior to salicylate of soda or salicin in their effects.

Senator proposed *sodium benzoate* as a substitute for sodium salicylate in the treatment of acute rheumatism, and he gave as much as 2 to 3 drams daily. He claimed for this salt that it did not cause any toxic effects or disorder the stomach, as the salicylates do, while it was as powerful a remedial agent.

The pain-relieving properties of the salicyl compounds has led to the disuse of **opium** for the purpose of assuaging the pain and restlessness of sufferers from acute rheumatism. But this drug has, perhaps, been too completely set aside. Opium was found, before the introduction of the salicylates, a most valuable agent in allaying the pain and the cardiac excitement in severe cases, and its known influence over the capillary circulation may give it some control over the endocardial inflammation.

We still think that in cases with signs of commencing endocarditis and cardiac excitement it is a good plan, after a mercurial and saline purgative, to begin treatment with a full dose of opium, such as 15 grains of Dover's powder, in a draught, combined with a dram or two of acetate of ammonia, and an ounce of camphor water, and to repeat this dose nightly for three or four nights. We should then give the salicylates only during the day, as we might look to the opium to procure several hours of sleep at night. The constipating tendency of opium must be counteracted by a saline aperient in the morning. We treated many cases of acute rheumatism in this way, before the salicylates became popular, with excellent results, by a few doses of opium at the onset, together with alkalies combined with quinine.

This brings us to the discussion of the **alkaline treatment** of acute rheumatism, which we do not think should be wholly set aside for the salicylates, although we are convinced of the value of the latter. There certainly seems to be reliable evidence that free alkaline treatment diminishes the tendency to cardiac complications, and we are strongly disposed to think that the best treatment of acute rheumatism will prove to be a combination of the alkaline and salicylate treatments, together with the consumption of the largest possible quantity of **pure water** or milk and water, and this is practically the treatment we have already advocated.

Those who accept the *diplococcus rheumaticus* as the causal agent of acute rheumatism, will find justification of this empirical method of treatment in the further observation that this micro-organism elaborates strongly acid products. The advocates of the alkaline treatment pushed this method a little too far; and the large quantities of the potash salts recommended by certain authorities no doubt induced serious cardiac depression in some patients.

Little objection could, however, be offered to Garrod's method, which was to give 20 grains of potassium bicarbonate every three or four hours, night and day, until the cessation of the fever, and with this he combined full doses of quinine: others have given 30-grain doses of potassium bicarbonate every three or four hours, until the urine is rendered alkaline.

Fuller's method was to dissolve 90 grains of sodium bicarbonate and 30 grains of potassium acetate in 3 ounces of water, and render this effervescent by adding an ounce of lemon-juice, and to give this dose every three or four hours until the urine became alkaline, when the dose was reduced, and only enough given to keep the urine alkaline. A tendency has recently been manifested to adopt the method we have already referred to with approval, of combining the salicylate with the alkaline treatment. We have long done so, and, we think, with much advantage. It will have been noted that, when describing what we believe to be the best dietetic management of these cases, we urged the importance of the very free consumption of watery fluids containing some alkaline salt. If the doses of the salicylates be administered, as we have suggested, in these beverages, we shall obtain a combined alkaline and salicyl treatment; while the importance of the ingestion of large quantities of water, for diluent and eliminative purposes, cannot, we think, be overestimated. Or the treatment may be commenced with 20-grain doses of sodium salicylate and 30-grain doses of potassium bicarbonate in 2 ounces of water every two or three hours, and this may be made to effervesce by adding to it a dessertspoonful of lemon-juice, or 20 grains of citric acid; when the temperature falls, the dose of salicylate may be diminished to 10 grains; and when the urine has also become alkaline the mixture may be given every five or six hours only.

We wish to repeat that we think the best substitute for sodium salicylate, and to be preferred to it in many cases, is salicin.

In patients who appear to be unduly depressed by the salicylic treatment, it is a good plan to alternate it with quinine in 2- to 5-grain doses in effervescence.*

We may now summarise the chief of the preceding recommendations thus briefly:—Opium, at first (after an aperient), to relieve the pain and nervous distress and restlessness; saline purgatives for eliminative purposes; as free a consumption of water as possible for the same purpose, and to dilute and wash, as it were, the morbid blood; salicin, or salicylates, for their special effect on the joint affection and the pyrexia; alkalies for their modifying influence on the blood and the secretions and their established influence in protecting the heart; quinine for its tonic as well as its antipyretic effects.

In lingering subacute cases, which have resisted the action of moderate doses of the salicyl compounds, *potassium iodide*, 5 grains three times a day, combined with 10 or 15 grains of potassium bicarbonate, will often be found very useful; but we cannot commend its use, as has been done, in acute cases or in the early stage.

Should evidences of *pericarditis* or *endocarditis* appear they should be dealt with according to the principles already laid down in the chapter on the treatment of these affections.†

We cannot too strongly insist on the necessity of daily auscultation and percussion of the cardiac regions in order that any change in the cardiac condition may be noted.

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* *See* vol. i., p. 646.

† *Ibid.*, p. 353.

The occurrence of **hyperpyrexia**—and by that is meant a temperature over 105°, and continuing to rise—calls immediately for active measures for its reduction. The cold bath has been proved to be the most trustworthy means for this purpose. Dr. Wilson Fox was the first physician to apply this method in England, and the success which attended it, in his hands, even in extreme cases (in one the temperature in the rectum was 110°), encouraged others to follow his example. Recovery, however, does not always follow the cold-bath treatment; death from collapse has been repeatedly recorded after reduction of the hyperpyrexia by this means, and death has occasionally occurred even during the immersion. It will be prudent, therefore, not to allow any unnecessary delay in the application of the bath; and as soon as the temperature, after steadily rising, notwithstanding such remedial measures as we have already set forth, reaches 105°, preparations should immediately be made for immersing the patient. If cerebral symptoms, such as convulsions, occur, even with a temperature of not more than 104°, we should not delay to employ the cold bath. The bath must be repeated as soon as the temperature again rises above 105°. As many as twenty-five or twenty-six baths have been given in the same case. The temperature of the bath must not be lower than 90° at first, otherwise the patient will feel an unpleasant chill on entering it; but so long as the temperature of the water is between 90° and 100° the immersion will be agreeable to him. After he has been lowered into the bath on a sheet, the temperature may be further reduced by the addition of cold water, until it reaches 75° to 70°. When the temperature in the rectum has reached 102° the patient should be removed, as the temperature will continue to fall after his removal. On his return to bed some stimulant should be given him, a blanket thrown over him, and he should be allowed to sleep; should he show any signs of heart failure in the bath, stimulants must be freely given, and he must be at once removed to bed. It must be remembered that there is a great tendency to sink from cardiac failure in these cases, and free stimulation may be needful; as much as six ounces of brandy within an hour was given to one of Dr. Wilson Fox's successful cases, and warmth had to be applied to the back, and hot bottles to the feet. If a cold bath is not procurable, the next best measure is rapidly rubbing the patient with ice. Two nurses, each with a suitably shaped large lump of ice, wrapped round with thin flannel, should repeatedly pass the ice over the whole of the anterior surface of the body, and at the same time a bag filled with pounded ice should be applied to the spine and back of the neck, and another on the head. The patient should also be constantly given fragments of ice to suck.

The favourable effects of the cold bath are to allay delirium, restore consciousness, reduce the rapidity and increase the strength of the pulse, and induce tranquil sleep, as well as lower the temperature.

It only remains to be said that the **convalescence** of a patient from acute rheumatism should be carefully watched. He should be kept in bed for a considerable time after all the symptoms of the joint affection have disappeared, and this is especially important in cases with any cardiac complication. In such cases the work of the heart should be minimised in every possible way, and chiefly by absolute rest for some weeks. Pain is apt to return in the joints if they are used freely too soon. The food, though nourishing, should be as light as possible, and chiefly composed of milk and farinaceous substances. Light broths, with fresh vegetables in them, are suitable; and some cooked fruit or fruit-jellies may be taken with light puddings.

We have already insisted on the propriety of continuing some salicyl preparation for a fortnight after the cessation of the acute symptoms, in order to guard against relapses.

If we give salicin, it is as well to add to each dose (thrice daily) 1 grain to 3 grains of quinine. On leaving off this medicine, the anæmic state which is apt to follow these attacks calls for some preparation of iron. The citrate of iron and quinine, in 5- to 10-grain doses, combined with 20 grains of potassium citrate, may be given three times a day; and when there are notable signs of cardiac debility, 3 to 4 minims of the liquor strychninæ should be added to each dose. The bowels should be kept regular by saline aperients. Patients who have had more than one attack, and in whom some cardiac affection has been left by the original illness, will need more supporting and tonic treatment during convalescence. They may require a certain amount of light animal food, eggs, soup, etc., and a small amount of some alcoholic stimulant. Cardiac tonics, such as digitalis and iron, may be needed; but prolonged rest in bed is one of the best tonics to these damaged hearts. As an attack of acute rheumatism does not protect from but rather predisposes to others, it is a wise precaution in one who has thus suffered to wear always warm woollen clothing and to take special care of the throat, since it is believed that the infective agent probably enters by the tonsils.

It is important, too, that a rheumatic subject should reside in a locality with a dry, well-drained soil. The first reminder, however slight, should never be neglected, but treated promptly and thoroughly, so as to forestall a severe recurrence.

ADDITIONAL FORMULÆ

Salicylate mixture for acute rheumatism

℞ Sodii salicylatis, ʒiij.
Syrupi zingiberis, ℥j.
Aquæ ad ℥vj.

M. f. mist. A tablespoonful every three hours.
(*Prof. J. Stewart.*)

Combined alkaline and salicylate mixture

℞ Sodii salicylatis, ℥ss.
Potassii bicarbonatis, ʒvj.
Liquoris morphinæ hydrochloridi, ʒjss.
Aquæ camphoræ ad ℥xvj.

M. f. mist. Two tablespoonfuls four times a day.
(*Whitla.*)

Pills of salicylic acid

℞ Acidi salicylici (nat.), gr. c.
Gummi acaciæ, gr. xv.
Mucilaginis acaciæ, q.s.

Ut f. pil. xxx. Six to be taken every hour until buzzing of the ears occurs, then every four hours. (*Latham.*)

Mixture and powders for acute rheumatism

℞ Potassii acetatis }
Potassii nitratis } āā ʒjss.
Syrupi mori, ʒvj.
Aquæ ad ℥viij.

M. f. mist. A tablespoonful three times a day.

℞ Sodii salicylatis, ʒjss.

Divide in pulv. xij. Take four powders a day.
(*Billroth.*)

Salicylate of ammonia and soda mixture

(Said to avoid unpleasant symptoms.)

℞ Sodii bicarbonatis, gr. v.
Ammonii carbonatis, gr. v.
Acidi salicylici, gr. xx.
Aquæ ad ℥j.

M. f. haust. To be given for a dose. (*Prideaux.*)

Alkaline mixture with bark

℞ Sodii bicarbonatis }
Potassii acetatis } āā ʒss.
Tincturæ cinchonæ, ʒjss.
Decocti cinchonæ flavæ ad ℥jss.

M. f. haust. For a dose.
(*Fuller.*)

Alkaline spray for inhalation in rheumatic endocarditis

℞ Sodii bicarbonatis, gr. xx.
Aquæ destill. ℥iij.

M. f. tol. To be inhaled for a quarter of an hour three or four times a day.

Lotion for the painful joints

℞ Tincturæ opii, ℥j.
Potassii carbonatis, ℥ss.
Glycerini, ℥ij.
Aquæ ad ℥xij.

M. f. lotio. To be applied by means of lint. (*Fuller.*)

Application to the joints in acute rheumatism

℞ Ichthyolis, ℥ss ad ℥j.
Adipis, ℥ij.

M. f. ung. Rub in well to the part affected. (*Hare.*)

Another

℞ Acidi salicylici, gr. cxx.
Alcohol (absolute), ℥j.
Olei ricini, ℥iss.

M. f. linim. (*Ruel.*)

Iron and arsenic mixture for anæmia

℞ Liquoris arsenicalis, ʒj.
Syrupi ferri iodidi, ʒix.

M. Ten to thirty drops, gradually increased and according to age, after meals twice or thrice daily. (*Packard.*)

Liniment for fixed pain in the joint

℞ Olei sinapis, ♏xij.
Spiritus terebinthinæ, ʒvj.
Linimenti saponis, ʒvj.

M. f. lin. To be applied twice or thrice daily.
(*Bamberger.*)

Salicin and alkaline powders

℞ Salicini, ʒij.
Potassii bicarbonatis } āā
Sodii bicarbonatis } ʒjss.

M. et divide in pulv. vj A powder, every three or four hours, dissolved in a wineglassful of hot milk and water.

Alkaline mixture in effervescence

℞ Sodii bicarbonatis, ʒss.
Potassii acetatis, ʒss.
Liquoris ammonii acetatis, ʒiij.
Aquæ ad ℥ij.

M f. haust. To be taken in effervescence with

℞ Acidi citrici, ʒss.
Aquæ, ℥ij.
M. (*Fuller.*)

CHAPTER II

TREATMENT OF DIPHTHERIA AND WHOOPING COUGH

Diphtheria—A *Bacillary* Disease and a *Local* Disease—Nature of Infective Process—The Klebs-Löffler Bacillus—Etiology of Diphtheria—Modes of Contagion—Symptoms and Course—Pharyngeal, Nasal, and Laryngeal Forms—Constitutional Symptoms—Complications—Paralyses—*Indications for Treatment*—*Local Measures*—Antiseptic Applications—Caustics Injurious—Warm Irrigations—Sprays—Paints—Corrosive Sublimate—Carbolic and Alkaline Spray—Other Local Remedies—*Internal* Medication—Perchloride of Iron—Sodium Benzoate and other Drugs—Food and Stimulants—Treatment of Nasal Form—Of Laryngeal Form—Emetics—Operative Measures—Intubation—Tracheotomy—*Specific Antitoxine Treatment*—Treatment of Convalescence—Of Diphtheritic Paralysis—Strychnine—Massage—Electricity—Prophylactic Measures.

Whooping Cough—Nature, Characters, and Symptoms—An Infective Bacillary Disease—Indications for Treatment—(1) Antiseptics—(2) Anti-catarrhal Remedies—(3) Sedative Remedies—Treatment of Paroxysm—Maintaining Nutrition by suitable Feeding—Change of Air—Prophylaxis.

Additional Formulæ.

Diphtheria

Diphtheria is an infective **bacillary** disease characterised typically by a membranous exudation on the mucous membrane of the fauces, nose, or larynx chiefly, and in severe attacks it is accompanied by great constitutional prostration and the occurrence of degenerative changes, especially in the cardiac muscle, the peripheral nerves, and the renal parenchyma. These degenerative changes are caused by the absorption into the blood of one or more toxines, elaborated at the seat of the exudation by a specific bacillus, which is always present, and by appropriate means can be detected there.

This is the so-called Klebs-Löffler bacillus. The microbe does not usually enter the blood, but produces its morbid effects by its *local* activity, which results, as we have said, in the production of toxines that enter the blood and set up a general intoxication. Diphtheria is thus primarily, at any rate, a local infection, although recently, in some severe attacks, the bacillus has been found in the subjacent lymphatic glands, in the pulmonary tissue, and in the spleen.

The morphology of the Klebs-Löffler bacillus is now well known, and need not be detailed here.

It is a remarkable and interesting fact that we may frequently find bacilli in the throat, either alone or in company with the true diphtheria bacillus, which are morphologically, and in their behaviour in cultures, indistinguishable from it—but they are innocent and non-infective. It is a disputed point whether these are attenuated true diphtheria bacilli or examples of a distinct species They have been termed (incorrectly, Osler thinks) *pseudo-diphtheritic bacilli.*

Besides the specific bacillus, other microbes, pyogenetic and putrefactive, may be found associated with it in the exudation in all cases of this disease, and in some cases a mixed infection, from definite septic invasion, occurs. These cases of mixed infection are almost always severe ones.

Formerly the diagnosis of diphtheria rested on the presence of a sore throat with false membrane. With our present knowledge of the causation of diphtheria we apply the name to any sore throat in which Klebs-Löffler bacilli are found, and quite often these are without a trace of membrane. Furthermore, bacilli may be found in quite healthy throats, which are experimentally virulent, but yet produce no ill effects, so long as the throat remains healthy ; yet they may serve to communicate the disease.

With regard to the **etiology** of diphtheria, it is known as a highly *contagious* disease. It is difficult, however, to say in what manner it originates. Has it any relation to defective drainage? It has been suggested that exposure to emanations from drains may excite a non-infective sore throat, which may serve as a suitable soil or culture ground for the diphtheria germ, when present in the air. But what seem to be more influential factors than the inhalation of sewer gas are imperfect drainage of the surface soil, dampness of dwelling houses, and deficient scavenging. The diphtheria bacillus has never been detected in sewer air, nor has it ever been definitely traced to water pollution. Milk is an occasional medium of infection. Direct or indirect transmission from person to person is the most important and frequent mode of its diffusion.

There is no reason to believe that the virus can be conveyed by the breath of an infected patient; but by acts of coughing or spluttering when the throat is being examined and dressed, and by the discharge of saliva and buccal mucus from the mouth, or infective discharges from the nose as in sneezing or laughing, the virus may be scattered about on the bed-clothes, and on persons and articles of dress and furniture near the patient. Kissing, or using the same pocket handkerchief, cup, or spoon, is clearly an obvious way of conveying infection. The virus may attach itself with great tenacity to articles of furniture, curtains, carpets, etc., in the room in which the patient has been laid up. It has been proved that cats and dogs have conveyed the disease to children, as these animals are subject to a contagious pseudo-membranous affection.

Childhood is a predisposing cause to this as to most infective diseases. It has been found most fatal between the second and sixth year. An unhealthy condition of the mouth and throat, enlarged tonsils, chronic naso-pharyngeal catarrh, inflamed gums from carious teeth, etc., predispose to infection. Like some other infective diseases, such as scarlet fever, epidemics vary much in their severity. In some the infective agent appears to be very virulent and spreads rapidly, and the constitutional symptoms assume great gravity; in others the disease runs a mild course and is rarely fatal.

Individual susceptibility to this disease varies greatly—some seem to possess a singular immunity from infection, however much they may be exposed to it, and in a few instances bacilli have been found growing in perfectly healthy throats in the case of attendants and nurses in hospitals!

Formerly this disease was more frequent in rural districts in England, but of late years it has shown a tendency to affect large towns, in many of which it is now more or less endemic. This is believed to be connected with "school influence" and the spread of compulsory education. The massing together under the same roof, for several hours daily, of numbers of young children, some imperfectly fed and in a receptive condition and at a receptive age for all forms of infection, certainly favours the propagation and spread of diphtheria.

It is important to remember, especially with regard to school attendance, that a child remains a possible source of infection as long as any diphtheria bacilli can be detected in the secretions of the throat, mouth, or nose. It should also be borne in mind that an attack only confers immunity for a very short time, usually only three or four weeks, when a relapse or a distinct second attack may occur.

The period of *incubation* cannot be determined precisely, but it varies between twenty-four hours and four days. Ten or twelve days is considered a safe period of quarantine. It is safer, however, regardless of limits of time, to require two negative cultures from the throat before the child is set at liberty.

It is important to remember that this bacillus is very resistant, and has been cultivated from a fragment of membrane kept in a dry cloth for five months! The bacilli will also often linger in the throat and nose for many months after all membrane has disappeared; it has been shown, however, that as a rule these organisms are non-virulent when inoculated into guinea-pigs.

The clinical course and the **symptoms** of the disease vary with the severity of the attack. The onset is generally marked by difficulty in swallowing, redness of the fauces, and a rise of temperature often to 103° or higher. But diphtheria has no typical temperature curve, and some of the worst cases have a normal temperature almost from the onset. The characteristic exudation usually begins on the tonsils, and may not be distinguishable at first from that of follicular tonsillitis. The false membrane, however, soon extends, covering the tonsils and stretching to the pillars of the fauces, to the uvula, and often to the posterior wall of the pharynx.

The tonsils and the uvula and the mucous membrane covering the throat at the same time become swollen and œdematous, and the glands in the neck also often become enlarged and tender. The pseudo-membrane has at first a greyish-white aspect, but it soon assumes a dirty or yellowish-grey appearance. The membrane is firmly adherent, and if removed leaves a raw bleeding surface on which fresh exudation rapidly appears. In favourable cases, after the fourth or fifth day the severity of the symptoms abates, the false membrane separates and is not reproduced; the swelling of the throat is reduced, and the enlarged glands in the neck become smaller, the febrile temperature disappears, and convalescence may be fully established by the ninth or tenth day. But in other cases the disease runs a more formidable course; the false membrane may extend from the pharynx along the posterior nares into the nasal cavities, and set up *nasal* in addition to pharyngeal diphtheria, and this is attended by a foul acrid discharge from the nose, and much obstruction in respiration from swelling of the nasal mucous membrane. The disease may even extend to the conjunctivæ through the lachrymal ducts, or to the middle ear along the Eustachian tube. But the most serious extension of the false membrane is into the larynx; thence it may spread into the trachea and even into the smaller bronchi.

Laryngeal diphtheria is attended by the same symptoms as membranous **croup**, and there is a very general disposition to regard cases of so-called membranous croup as really cases of laryngeal diphtheria. The symptoms now become very serious and urgent. Owing to obstructed respiration, the breathing is noisy and stridulent, the inspirations shallow and rapid, and the sternum and lower ribs and intercostal spaces are retracted in inspiration; the surface becomes cyanosed, and if the embarrassed respiration is not speedily relieved the child dies asphyxiated.

In some cases the symptoms of grave constitutional infection appear early and take the more prominent place. But generally they correspond in severity with that of the local manifestation and appear later; acute heart failure and intractable vomiting are the most frequent. There is in these cases great prostration, with high fever, a small, feeble, and rapid pulse, marked disturbance of the nervous system, delirium, convulsions, etc., and the patient often sinks rapidly from the intensity of the constitutional infection. When these constitutional symptoms appear *later*, they are usually associated with extensive disease of the pharynx, sloughing, fœtid ulceration, and sometimes even gangrene, together with great enlargement of the lymphatic glands and an ashen-grey pallor of the countenance. The *nasal* form, if it occurs alone, often runs a mild course, and there is some risk of its being overlooked, which would be very serious, as the discharges from the nose, which occasionally contain shreds of membrane, are laden with diphtheria bacilli, and are therefore most infective; so that any nasal symptoms occurring during the prevalence of this disease should be investigated with great care. Diphtheritic exudation occasionally makes its appearance on the external genital organs and on the surface of open wounds.

The chief **complications** which may occur are infective bronchitis and broncho-pneumonia, and even pulmonary gangrene and fatal hæmorrhage in the graver forms of this disease. (The *streptococcus pyogenes* is often the infective agent in such complications as suppuration of the lymphatic glands and broncho-pneumonia.) *Albuminuria* of the ordinary febrile type is present in all severe cases; but in a few it may be abundant, and due to the occurrence of acute parenchymatous nephritis. One of the most serious complications of diphtheria is *paralysis.* Sometimes it appears early in the disease, but more usually not before the second or third week of convalescence, and it is apt to follow mild as well as severe cases. It commonly first affects the palate and gives a nasal character to the voice, and allows of the regurgitation of fluids, taken into the mouth, through the nose. If the paralysis extends to the pharyngeal muscles, swallowing may become difficult. The ocular muscles may be paralysed, giving rise to strabismus, ptosis, and failure of accommodation. Loss of power may also appear in the extremities. These various forms of paralysis are regarded as dependent on a toxic neuritis. The most serious form of diphtheritic paralysis is that directly affecting the **heart** muscle, manifested by great irregularity and often remarkable slowness of the pulse, and ending sometimes in fatal syncope; and it is important to note that symptoms of serious cardiac failure may be deferred till quite late in the attack, from the end of the second to the third or fourth week.

Diagnosis in diphtheria bears an important relation to treatment. The presence of the Klebs-Löffler bacillus is the criterion of true diphtheria. This is established or negatived by the examination bacteriologically of some of the material from the throat of the suspected patient, obtained by rubbing a sterilised swab of cotton-wool gently but firmly on the visible exudation; this is enclosed in a test-tube or properly adapted bottle, and sent to a bacteriological laboratory for examination. In purely laryngeal cases, when the swab has been rubbed freely against the surface of the pharynx and tonsils, absolute reliance must not be placed on a single culture from which the bacillus may be absent, as it may be abundant in later ones.*

To the membranous inflammations found in the throat, in which the Klebs-Löffler bacillus is not present, the name of *diphtheroid* inflammation has been given. This is, in many cases, caused by the *streptococcus pyogenes,* and it can only be distinguished with certainty from true diphtheria by bacteriological examination.

These cases, as a rule, run a milder course than those of diphtheria, but in certain fevers, as, for instance, scarlet fever, a virulent general streptococcus infection may take place which may prove fatal. Energetic local disinfection by antiseptic applications is indicated in these streptococcus infections.

The foregoing brief account of the nature and chief characters of diphtheria will help us to establish rational **indications** for its **treatment.** These may be divided into *specific* and *general:* the latter we will consider first.

1. The disease must be attacked *locally*, as quickly and as thoroughly as possible, as we may thereby prevent the local multiplication of the diphtheria bacillus as well as that of other infective microbes often associated with it.

2. The next indication is to support the constitutional vigour, and to help the system to resist or antagonise the toxic influence of the infective

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* The Lister Institute of Preventive Medicine, Chelsea Gardens, Grosvenor Road, London, S.W., provide "specially prepared tubes and boxes for the forwarding of specimens, price 1s. 3d. The membrane may also be forwarded in sterilised glass tubes or between folds of dry lint or blotting paper."

products of the diphtheria bacillus should they be absorbed.

3. A third indication is prophylactic, viz. to adopt measures to prevent the communication and spread of the malady. Other subordinate symptomatic indications arise in the course of the disease; such as the removal of respiratory obstruction in laryngeal cases, by operation if necessary, and the treatment of the paralysis which so frequently occurs as a sequel to this disease.

The success of the **local treatment** best calculated to fulfil the first indication will depend on the thoroughness with which it is applied and the opportunity we may be afforded of applying it *early*. **Early** application of antiseptic and specific measures is of chief importance. In the *early* stage the bacilli are mostly quite superficial, and can be reached by suitable antiseptic applications. But if the local disease has existed for some days before these are applied, there has been time then for the constitution to become affected by absorption of the toxine elaborated at the seat of infection. The extension also of the local morbid process into the air-passages is far more likely to occur when there has been any neglect of adequate early treatment of the pharyngeal manifestations, and it is this particular complication that proves so very fatal, not only because of the respiratory obstruction it produces and the serious operations necessitated for its relief, but probably because, in these cases, the constitutional infection is more intense, and the infective virus has reached a tract of mucous membrane which is more out of reach of our local remedies.

The **local** treatment should consist in the frequent and thorough application of **antiseptic** agents. Caustics are injurious, and should be avoided. They favour the extension of the false membranes by the injury they do to the adjacent sound mucous membrane, which they denude of its protective epithelium and irritate and inflame, and so produce a condition favourable to the attack of the infective microbe, and by provoking reactionary tumefaction they aggravate the dysphagia already existing.

At the same time an antiseptic application must be used of sufficient strength to be really efficacious.

If we can detach, or wash away, the false membrane while making our antiseptic applications, it is certainly advantageous to do so ; but on no account should it be forcibly removed.*

It is as well to remember that the virulence of the diphtheria poison is attenuated by moist heat and destroyed at a temperature of 137° F. We should therefore use our applications as hot as they can be borne without injury to the mucous membrane.

Irrigation with hot water or hot aqueous solutions of borax, or boric acid, or potassium chlorate, is one of the best mechanical means of detaching and washing away the false membrane. The following solution may be used very freely :—Borax, boric acid, of each 2 drams; chlorate of potash 1 dram, glycerine 4 ounces, hot water 1 pint.

These irrigations should be made frequently, with a ball-syringe capable of giving a strong jet of fluid. If we have to do with an infant or a restless young child, it is best to wrap its body and arms tightly in a shawl so that it cannot struggle, and for the nurse to hold it on her knees with its head firmly supported on her chest. Another assistant should hold a basin under the child's chin. The nose must be pinched, and as soon as the child opens its mouth a piece of wood should be placed between the molars, and then the nozzle of the syringe or irrigator should be directed with a strong jet to every point of the throat and fauces. After the throat has been thus cleansed (adults can use the hot fluid as a gargle for the same purpose) the stronger antiseptic agent we have determined to employ may be applied by means of a pulverising apparatus (and this is best if the nose or larynx should be attacked), or by means of a pledget of cotton-wool firmly tied on to a piece of stick (to be burnt immediately after use). This is the best method of applying strong antiseptic agents which we cannot conveniently use, of the same strength, as a spray. These applications must be made with gentleness and so as to do no injury to the inflamed mucous membrane. One of the best local applications in pharyngeal diphtheria is the *perchloride of mercury*; but it is generally used in too dilute solutions. For adults and for older children a 1 in 250 solution in alcohol may be used by means of cotton-wool or a fragment of sponge (tied on to a stick) dipped in the solution, and the excess of fluid pressed out before it is applied to the throat. The application should be made three or four times a day, and by using a strong solution such as this, which is brought into contact only with the infected parts, very energetic antiseptic action is ensured. We have used for younger patients an aqueous solution of 1 in 500 in the same way and very successfully. Others employ weaker solutions and apply them much more frequently, or use them as a spray (1 in 1,000 to 1 in 5,000 of water). In the latter case it should be used as hot as it can be safely applied. For *nasal* diphtheria the spray recommended by Jacobi is a good one. It is made with 1 part of bichloride of mercury and 35 parts of chloride of sodium to 1,000 of water.

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* The substances that have been used to dissolve the false membrane are lime water, lactic acid (5 per cent. solution), solutions of pepsin and of papain, lemon juice, solution of neurin (Ludwig), solutions of chlorate of potassium and chlorate of sodium, and peroxide of hydrogen. These have fallen into disuse since the general adoption of the antitoxine treatment.

We prefer, however, to use the stronger solutions for pharyngeal cases, while to protect the air-passages from infective invasion we employ, at the same time, the following spray, which, by means of a Seigle's steam spray-producer, we keep playing in front of the child's mouth and nose (if very young and unable to inhale) at intervals: Glycerine of carbolic acid 6 drams, sodium bicarbonate 60 grains, and hot water 6 ounces. By a suitable contrivance the air around the child's head can be kept moist with this spray, which thus enters, in some amount, into its larynx and trachea.

One of the advantages of the alkali and the glycerine is that the spray is enabled to **wet** thoroughly the mucous membrane with which it comes in contact.

Many other local applications have been employed, such as a saturated solution of boric acid; a solution of methyl-blue (1 to 9 of water); a 10-volume solution of peroxide of hydrogen (strongly objected to by Crandall on account of its irritating effects); strong solutions of potassium chlorate; chlorine water; sulphurous acid spray; carbolic acid 3 parts, alcohol 30 parts, to water 67 parts; the tincture of perchloride of iron diluted with 2 to 5 of water and glycerine; insufflation of sublimed sulphur; painting with tincture of iodine, with tolu varnish, with petroleum, with a 2 per cent. solution of creolin, etc. etc. Löffler stated that ferric perchloride killed the diphtheria bacillus very rapidly, and his local application consisted of 4 c.c. of liq. ferri perchloridi, 10 grammes of menthol dissolved in 36 c.c. of toluol, and absolute alcohol 60 c.c.

An *antimicrobial diphtheria serum* has been prepared for local application to the throat, concurrently with the subcutaneous or intravenous administration of antitoxine. In the case of very young children it may be painted on the fauces every three or four hours. Pastilles of the dried serum incorporated with gum may be used for older children, to be slowly sucked at frequent intervals. French observers have claimed some success for this treatment.

If there is apparent weakness of the heart, or the child is exhausted, and its struggles during the process of local treatment are likely to be harmful, it will be wise to dispense with such measures entirely. The introduction of antitoxine has done much to diminish the essential importance of local antisepsis.

Suitable internal remedies are also needed to maintain the forces of the organism, and to enable it to resist the invasion of the toxic agents developed at the seat of infection. The strongest testimony is borne by a host of observers to the efficacy of the internal administration of **perchloride of iron;** a part of this efficacy we believe to be due to its antiseptic action on the infected throat as it is swallowed. For a child of one year 2 minims and for a child of three years 5 to 10 minims of the tincture with 1 to 3 grains of potassium chlorate in a teaspoonful or two of syrup and water should be given every hour. Larger doses must, of course, be given to adults.

For an adult or a child over ten years of age the following is an excellent mixture :—

℞	Tincturæ ferri perchloridi	♏ clx.
	Quininæ sulphatis	gr. xxiv.
	Potassii chloratis	gr. xlviij.
	Aquæ chloroformi	ad ℥viij.

Misce, fiat mistura. A tablespoonful with one of water every hour or two, according to the severity of the case.

Sodium benzoate is a valuable antiseptic for internal use for children. The following is a formula for its administration :—

℞	Sodii benzoatis	ʒijss.
	Syrupi aurantii	ʒv.
	Aquæ menthæ piperitæ	℥iij.
	Aquæ	ad ℥vj.

Misce, fiat mistura. A dessertspoonful every hour (for a child of three years). The dose is increased with the age of the child.

Biniodide of mercury, salicylic acid, sodium salicylate, turpentine, thymol, helenine, used internally, have all been credited with curative powers in the treatment of this malady.

Complete rest in bed is of paramount importance in the treatment of diphtheria. Even in the mildest cases, fatty degeneration of the heart muscle is prone to occur. Neglect of this precaution is the cause of serious syncopal attacks. The duration of recumbency will vary with the severity of the attack, the general condition of the patient, and the evidence afforded by daily examination of the heart and pulse.

Judicious **feeding** is an important element in the treatment of these cases; fluid or semi-fluid foods only can be given, milk, nutritious broths and soups, beaten-up eggs, pounded meat mixed with light broth, coffee with milk, cocoa, and a due amount of alcoholic stimulant in severe cases should be given regularly at stated intervals. When the pain of swallowing leads to refusal of food, we may paint the fauces with a 1 to 2 per cent. solution of cocaine; or an orthoform lozenge (gr. $\frac{1}{4}$), or in older children small pieces of ice, may be allowed to dissolve slowly in the mouth. Hot fomentations may be applied to the neck, if the cervical glands are painful. Any indications of cardiac failure must be met by an increase in the amount of wine or brandy, which should be given at short intervals, until the action of the heart improves. If, as often happens, cardiac exhaustion is associated with uncontrollable vomiting, the best plan is at once to withdraw all food by the mouth, and inject a pint of normal saline solution into the subcutaneous tissues. We may also give hypodermic injections of strychnine ($\frac{1}{30}$ grain upwards), of brandy (20–30 m.), or of camphor dissolved in oil (1 in 5) and sterilised (10 m. doses), at intervals of an hour for 4 or 5 doses, or adrenalin chloride 1 : 1,000 (5 minims) repeated every half-hour for several hours. It is well to dilute the dose up to half a dram so as to avoid pain at the site of injection. Inhalations of oxygen will be indicated if there is severe dyspnœa or cyanosis, and collapse with coldness of the extremities must be met by hot bottles to the surface of the body. Digitalis should be avoided in the face of acute cardiac failure; its action on the degenerate heart muscle is ineffectual, and there is danger of its irritating the stomach and exciting vomiting if given by the mouth.

Nasal diphtheria, with a sanious or bloody discharge from the nostrils, may arise primarily, but it is more commonly an extension from the pharynx into the posterior nares. Its occurrence by extension usually indicates a severe form of the disease, and the constitutional infection is apt to be severe, so that large doses of antitoxine should be given. Irrigation and spraying of the nasal cavities must be diligently carried out with the carbolic acid and sodium bicarbonate spray we have already mentioned, or borax or potassium chlorate in weak solutions with glycerine may be used ; or a weak solution of corrosive sublimate may be employed as a spray. Objection is sometimes taken to irrigation of the nostrils as likely to provoke middle-ear disease. If preferred, twisted pledgets of cotton-wool, soaked in a weak antiseptic, may be used for cleansing, in place of irrigation.

There is also a chronic form of nasal diphtheria (membranous rhinitis) in which Klebs-Löffler bacilli have been identified, but there is no constitutional disturbance. These cases are not benefited by antitoxine, as we should expect, inasmuch as it possesses no antibacterial properties. The condition may however, it is believed, convey the disease in a virulent form to others.

Laryngeal diphtheria also may be primary or secondary ; more commonly, like the nasal form, it is an extension of the false membrane downwards from the pharynx.

When this serious complication occurs with a child, its bed should be enclosed in a tent, and the enclosed space kept moistened with steam from a kettle provided with a long tube, as shown in Fig. 21. If a piece of sponge is attached to the end of the tube and kept moistened with turpentine, eucalyptol, or pinol, the air of the tent will become charged with these antiseptic vapours.

In these cases the use of a hot spray of carbolic acid and sodium bicarbonate (as already formulated) playing in front of the mouth and nostrils by means of a large spray-producer, as shown in Fig. 21, is of the greatest service.

The steam-kettle or spray should only be used for short periods at a time, as a continuous atmosphere of steam is seriously exhausting.

The internal administration of corrosive sublimate has been specially advocated when this complication threatens, and as much as half a grain has been given daily in divided doses to a child a year old. The usual dose is about $\frac{1}{100}$ grain every hour in milk. It must not be continued more than three or four days.

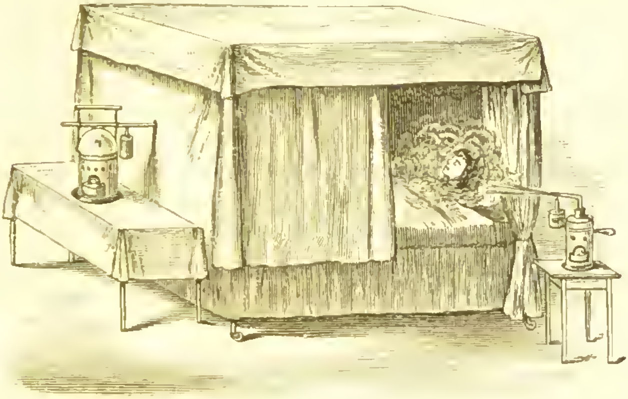

Fig. 21.—Tent with Spray Apparatus for Laryngeal Diphtheria.

Emetics are often prescribed at this stage to promote the expulsion of false membranes formed in the larynx and trachea, and sometimes with success; for this purpose ipecacuanha or sulphate of zinc may be used. Apomorphine is, we consider, too depressing an agent to be employed in this disease. We should confine the use of emetics to strong children.

If vomiting fails to relieve, if restlessness is increasing, and the signs of respiratory insufficiency remain urgent, **tracheotomy** or **intubation** must be performed. It is not desirable to wait until the respiration has become greatly impeded before we operate, as the chances of recovery are greatly imperilled by delay. *Intubation* has not met with so much support in England as in Germany and America. So far as statistics show, the recoveries after either of these operations are about equal. Intubation is only applicable in hospitals, or where skilled medical aid is continuously at hand. In private practice it must needs give place to tracheotomy. It is only by constant performance that the necessary skill can be acquired and maintained. There is always the danger of sudden blocking of the tube, or of its expulsion by coughing—grave occurrences when skilled assistance is not at hand. Moreover, there is the difficulty of nasal feeding, and this is impracticable when the nares are blocked. Too often also an initial intubation is apt to end in tracheotomy, performed under unfavourable conditions.

The tracheotomy tubes inserted should be previously well soaked in hot antiseptic fluid, and the inner tube should be removed every two hours and similarly treated before its reintroduction. The outer tube should be cleansed with a feather (to be immediately burnt) of any adherent secretions or fragments of membrane ; it should be removed and cleansed after twenty-four hours. The atmosphere around the patient should be kept periodically moistened with steam and antiseptic vapours as already described. Early attempts should be made to encourage the child to breathe through the mouth and the nose by stopping the orifice of the tracheotomy tube with the finger for short periods at a time. Before attempting to withdraw the tube, it may be plugged continuously with a small wooden peg, so as to make sure that it may be safely dispensed with. In all cases the tube should be finally removed as soon as practicable.

SPECIFIC TREATMENT BY ANTITOXINE

But the *most important* indication is to bring the patient as rapidly as possible under the influence of the *specific* treatment by *antitoxic* serum. Early administration is the most important condition of success. It is rare for laryngeal symptoms to supervene unless they have been present before the antitoxine was administered. The introduction of this mode of treatment was based on the observation that a substance is present in the blood-serum of immunised animals which has the power of conferring a certain degree of immunity on other animals, and even of arresting the disease after it has become developed.

The method was first introduced by Professor Behring, one of Koch's pupils, and to him and Kitasato belongs the honour of this discovery.

The immunising serum is thus prepared: In the first place, the toxines are obtained in considerable quantity by cultivating the virulent diphtheria bacillus in a suitable medium; the cultures are filtered, and a clear liquid containing the toxines is obtained.

The next step is to *immunise* the animal that is to be used for the production of the antitoxic serum. Great caution and care is needed in carrying out this process, which need not here be detailed.

The horse is the easiest animal to immunise and from which to obtain large quantities of serum. This animal bears the process better than any other. Moreover, its serum is comparatively innocuous to man; injected under the skin, it is quickly absorbed and causes no local irritation. It may, however, produce unpleasant after-effects. It is easy also to withdraw large quantities of blood from the jugular vein of the horse from which a perfectly clear serum separates. The process of immunisation of each horse takes about three months. Finally the standardisation of the antitoxine, *i.e.* the measure of its strength, is determined by physiological experiments on guinea-pigs.

The serum possesses both curative and prophylactic powers, and the quantity needed in each case will vary according to the concentration of the serum, the amount of toxine developed in the body, and the period at which the injection is first made; it is independent of the age of the patient, but depends wholly on the gravity of the attack. Its power is due to a substance termed *antitoxine*, of the actual nature of which, as of that of the diphtheritic *toxines*, we know next to nothing. The immunity against diphtheritic toxines acquired by animals injected with this antitoxine does not last long, and may disappear in a few days or a few weeks, according to the strength and the amount of the serum employed.

How and in what manner the antitoxine acts is not known: it is clearly a more complex process than one of neutralisation by simple chemical combination. Several preparations are in the market by different makers, and reliable supplies can be obtained from most of the well-known manufacturing chemists. The therapeutic potency of these preparations is calculated in *units*. One unit is the smallest quantity which, being mixed with 100 minimum lethal doses of toxines, injected into a medium-sized guinea-pig, prevents the appearance of any toxic symptoms. The quantity employed for each injection varies usually from 5 to 20 or more cubic centimetres, according to the strength of the preparation. These doses are supplied in hermetically closed phials,* the whole contents of which should be injected at once, subcutaneously, in either flank. The skin must previously be thoroughly cleaned with an antiseptic lotion and the syringe also completely sterilised. The puncture should be covered with a small collodion dressing. "The syringe, both before and after use, should be thoroughly washed with cold water, then boiled for five minutes."† If the patient is seen early, and the disease is only of average severity, and confined to the fauces, a moderate dose may be given of 2,000 to 3,000 units, and it is usual to continue injecting half this dose every twenty-four hours until the membrane begins to separate; but if the disease has assumed a severe form, and especially if the larynx and nares are involved, and this treatment is not applied early, large doses of serum must be given, not less than 4,000 to 8,000 units at each injection. It is well in all cases to make the first dose a relatively large one, whatever the subsequent doses may be. Larger doses than these are urgently advised by some competent authorities; when we have to deal with "very severe and apparently hopeless cases," as much as 10,000 units, repeated four or five times if needful.* In this country we rarely exceed 8,000 units, repeating the injection every eight to twelve hours until its characteristic effects and definite improvement have set in, *i.e.* the membrane begins to shrivel and separate, the swelling of the fauces abates, the nasal discharge lessens, and the patient's general condition and aspect show an obvious improvement. A plea has been put forward for intravenous injection of antitoxine in serious cases, on the ground of greater rapidity of action.

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* All the sera and vaccines prepared by the Lister Institute may be obtained from the wholesale agents, Allen and Hanburys, Limited.

† From directions issued by the Lister Institute of Preventive Medicine.

The prophylactic dose is much less, from 200 to 500 units. This should, in our opinion, be administered to every child who has been directly exposed to infection. Exception should only be made when a child can be kept under observation and cultures made each day from the throat: then, even if infection should occur, antitoxine treatment can be initiated at a stage early enough to preclude almost all risk to life. It is of course open to question whether we should accept even this small risk, when the possible ill effects of injection are so slight. The immunity does not last longer than three weeks. The serum is said to keep active for eighteen months or more, if it is preserved in a cool place, unopened and protected from light. Although deterioration will have progressed, a serum of even three years, carefully kept, possesses some antitoxic power, and should therefore be used rather than lose the precious time that may elapse before a fresh serum is available.

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* Dr. McCallum, of the Boston City Hospital, quoted by Osler, "Practice of Medicine" (4th edition), p. 156.

The only ill effects that have been observed as attributable to the serum are the occurrence of urticarial and other eruptions, together with some pains in the joints and a little fever. Inasmuch as the severity of these after-effects is apt to be proportional to the amount of serum employed, it is desirable to use a serum of high potency: such are to be had, but at considerably higher prices than those of ordinary strength. Most sera contain about 300 to 500 units in each cubic centimetre, so that it is seldom necessary to give more than 5 c.c. for a single injection. These after-effects commonly appear about the eighth day after injection, but may appear as early as the second day or as late as the end of a month. Weak carbolic lotions—1 in 50—may be used for the urticaria, while evaporating lotions, or lead and opium lotion, or a glycerine-of-belladonna application, will relieve the associated arthritis.

The result of this treatment, as carried out in the hospitals of the Metropolitan Asylums Board over a period of fifteen years, has been to reduce the mortality from 30·3 to 9·3 per cent. of all cases. The results in tracheotomy cases are also very striking: within five years the mortality fell from 71·4 to 37·1. The best results are obtained when the treatment is begun early. Among 6,556 cases treated at the Brook Fever Hospital, the mortality of 250 receiving the injection on the first day was nil; second day, 4·3 per cent. of 1,513; third day, 11·2 per cent. of 1,690; fourth day, 16·9 per cent. of 1,338; fifth day, and after, 18·6 per cent. of 1,765. The rule should be to use the serum in every suspected case without waiting for a positive diagnosis. Against the use of antitoxine it is sometimes urged that the percentage of diphtheritic paralysis has increased. This, however, should be set to the credit of treatment, which keeps alive many serious cases that formerly died: paralysis is most apt to follow the severe cases.

Great care is needed during **convalescence.** To avoid the danger of sudden attacks of syncope, the patient must be kept in the recumbent position as much as possible, and not allowed to feed himself. When allowed even to sit up in bed, the effect on the heart and pulse should be carefully observed. On leaving bed, he should be confined to an armchair for awhile, before any attempt at walking is allowed. Nourishing food and tonics must be freely given. Should symptoms of **paralysis** appear, the patient must be kept at rest and all exertion forbidden. If there is much difficulty in swallowing from pharyngeal paresis, it may be advisable to feed the patient with the stomach tube, but it should be avoided when possible because of the strain which struggling and fright throw on the heart. Regurgitation of fluid through the nose may be prevented by rendering the food less fluid. Thus milk may be made into a soft jelly with isinglass, and sugar and brandy may be added if desired. Electricity and massage may help in the restoration of the nutrition and power of the muscles. Hypodermic doses of strychnine should be given from the first.

For children gentle massage and friction are preferable, as they are alarmed and fretted by electrical appliances.

In applying electricity, the slowly interrupted current is the best—the negative pole being placed over or as near as possible to the affected muscles, and the positive pole at the back of the neck, if the muscles of the upper part of the body are affected, and over the lumbar region when those of the lower limbs are involved. In regulating the current the object should be to excite muscular contraction without causing more pain than is unavoidable.

In cases in which recovery is long delayed the injection of strychnine in increasing doses has been attended with much benefit. It must be remembered, however, that diphtheritic paralysis tends to disappear spontaneously in a few months, although it may sometimes persist much longer; but there can be no doubt of the value of strychnine as a cardiac tonic in these cases. It may also be given in the following combination:—

℞ Ferri et quininæ citratis	gr. lxxx.
Liquoris strychninæ	♏xxxij.
Acidi hydrochlorici diluti	♏lxxx.
Aquæ chloroformi	ad ʒviij.

Misce, fiat mistura. Two tablespoonfuls twice or three times a day, an hour after food. (For an adult.)

Or in the following for a child:—

℞ Syrupi ferri phosphatis	ʒj.
Calcis hypophosphitis	gr. xlviij.
Quininæ sulphatis	gr. xxiv.
Liquoris strychninæ	♏xlviij.
Acidi phosphorici diluti	♏xxiv.
Aquæ	ad ℥iv.

Misce, fiat mistura. One or two teaspoonfuls, according to age, twice or thrice daily.

The throat should be treated with local antiseptics or by simple irrigation throughout the period of convalescence, as bacilli are apt to remain in the throat after the active process has subsided, and may be a means of communicating the disease.

Should a patch of diphtheritic false membrane appear on the skin, as it may do occasionally from the bacillus falling on some abrasion of the surface, it should be removed by forceps and the raw surface well washed with a 1 in 1,000 sublimate solution, then covered with naphthol camphor (see formulæ at end of chapter), and a small piece of cotton-wool fixed over it with collodion.

Prophylactic measures are most important. The patient with diphtheria must be strictly isolated, and other children in the house or family should be, if practicable, removed elsewhere. If this is not possible, they should be placed in a part of the house remote from the patient, and be made to use a disinfecting mouth-wash three or four times a day, such as the following :—

℞ Potassii chloratis pulveris	ʒij.
Glycerini boracis	℥j.
Acidi borici	ʒij.
Glycerini acidi carbolici	℥j.
Aquæ menthæ piperitæ	ad ℥xij.

Misce, fiat gargarisma. To be shaken up and mixed with an equal quantity of hot water when used.

The danger of kissing and fondling is obvious.

Nurses can protect themselves from infection by keeping the hands washed with weak antiseptics, by the regular use of antiseptic mouth-washes and gargles, and by wearing plain glass spectacles when treatment of the throat or tracheotomy wound provokes coughing or spluttering. The occasional use of a lozenge of formamint, in which formaldehyde is bound up with lactose, is an agreeable prophylactic also.

The room selected for the patient should be large and airy, and it should have an open fireplace. It is best at the top of the house, as it is more difficult to maintain effective isolation on the lower floors. "Carpets, mats, curtains, ornaments, and all unnecessary articles of furniture should be removed. A sheet kept wet with disinfecting solution should be hung outside the door. Special attendants should be provided, and no others permitted in the sick-room. Dusters, towels, clothing, bedding, and utensils used in the room should be kept there and washed there, and not allowed to be carried through the house or used elsewhere. Soiled clothes, etc., should be covered with a boiling disinfectant solution before being taken from the room, and great care exercised in washing them. The discharges from the nose and throat (after gargling, etc.) should be received in an earthenware or glass vessel containing (hot) sublimate solution (1 in

5,000), or on pieces of clean, old, soft linen, which should be burned immediately. The evacuations should be received in glazed earthenware utensils containing sublimate solution (1 in 5,000). Cats, birds, dogs, or other household pets should not be allowed in the room, for they are often the means of spreading infection." The patient should not be given *books or journals or toys* that cannot be immediately destroyed. Food must not be left in the sick-room uncovered and unprotected, and milk especially needs protection, as it is most apt to absorb impurities from the air.

At the same time that the room is kept well ventilated, if there is any fœtor from the throat some vaporisable disinfectant and deodorant should be diffused through the atmosphere of the apartment, such as the following: Carbolic acid and oil of eucalyptus, of each 6 drams, and spirits of turpentine 4 ounces.

A tablespoonful of this mixture may be put on a hot-water plate, or it may be vaporised more rapidly from the surface of boiling water in a suitable vessel kept heated by a spirit lamp. Before leaving the sick-room the patient's whole body should be thoroughly washed with 1 in 60 carbolic lotion.

Diphtheria is hardly to be regarded as an air-borne disease at all. Still it will be a wise precaution, after the illness is over, to submit the sick-room and its contents to disinfection. We will, however, defer the detailed consideration of the methods of disinfection till we come to deal with small-pox, with which they will be more appropriately associated.

Whooping Cough

This epidemic, infective disease is characterised by a catarrhal condition of the air-passages, attended by a peculiar paroxysmal cough, often of great violence and intensity. The cough characteristic of the disease comes on in paroxysms, and consists of a series of rapid, short, explosive, expiratory efforts, and then a long-drawn, loud, *whooping* inspiration; this is repeated several times, according to the severity of the paroxysm, and usually ends with a more or less abundant discharge of extremely tenacious, viscid, stringy mucus, and at the same time the contents of the stomach are often expelled by vomiting. These paroxysms occur with varying frequency: in slight cases perhaps not more than three or four times in twenty-four hours, but in severe cases they recur with alarming frequency, even fifty to sixty attacks during the day and night, being usually more frequent at night. The child learns to dread these attacks, and often runs to its mother or clings to its nurse when it feels the attack coming on. Sneezing sometimes accompanies the paroxysmal attacks.

In prolonged and violent paroxysms the child becomes cyanosed, its eyeballs protrude, the face and neck become swollen, the conjunctivæ injected or even ecchymosed; blood occasionally pours from the nose, and sometimes appears in the expectoration; in rare instances the tympanum is ruptured and blood may be discharged from the ear. Convulsions are not uncommon in infants, and cerebral hæmorrhage has been known to occur. As may readily be imagined, the frequent and long-continued succession of these violent, convulsive, expiratory efforts is apt to lead to injury of the pulmonary tissues; bronchitis and broncho-pneumonia with lobular collapse are frequent complications, and pulmonary emphysema is developed, and may remain and cause habitual shortness of breath in after-life. Even pneumothorax has been known to occur. The bronchial glands are frequently enlarged (probably from an extension of the infective poison to them) and may become caseous.

Small ulcers have been observed to form under the tongue near the frænum, and are supposed to be caused mechanically, during the severe paroxysms of coughing, by the frænum of the tongue being thrust against the lower incisors.

Whooping cough is usually a disease of infancy and childhood, but it occasionally occurs in adults and even in aged persons. It is one of the most formidable diseases of early life, and, next to scarlet fever, is the most fatal of the infective diseases to which infants and young children are exposed. It is highly contagious, and one attack almost invariably proves protective from others. It is probably conveyed (and sometimes by a third person) in the clothes or perhaps the hair, and domestic pets, dogs, cats, etc., may also undoubtedly be the means of spreading the contagion; the contagious material being contained, doubtless, in the mucus which is discharged from the air-passages, and which may fall upon and adhere to surrounding objects. The characteristic paroxysmal cough is usually preceded (after an incubative period variously estimated at from four to eighteen days) by ordinary bronchial catarrh and coryza with slight feverishness, which may last from a week to ten days, and the occurrence of these symptoms in a child, especially if the cough is unusually frequent and obstinate, when the disease is known to be epidemic, should induce us to regard and treat the disease as whooping cough. Sometimes the characteristic cough never appears.

If allowed to run its course it lasts from six weeks to eight months, the paroxysms of cough gradually lessening in violence and the expectoration becoming looser and more puriform. Whooping cough is prone to follow measles, but what the precise relation is between the two infections is not known. Unlike other infective diseases, there is generally no fever during the characteristic stage, and the child appears quite well between the paroxysms unless any complication arises.

This disease probably depends on an infective micro-organism; several have been found in the expectoration and cultivated; but it is not certain whether the true virulent microbe has as yet been isolated.

Spengler, Wollstein, and others have described a bacillus, resembling that of influenza, in the sputum which it is thought may prove to be the specific microbe.

Early childhood is a predisposing cause, the greatest number of cases occurring between one and two years of age. Wintry, wet, and inclement weather favour the severity and duration of attacks, while in the warm summer season attacks are prone to be milder and of shorter duration. While an abundance of *fresh* air is conducive to recovery, exposure to a damp or cold atmosphere tends to excite serious complications. It is therefore extremely important to protect the child from taking cold. His room should have an equable temperature of about 65° F., and it is advantageous, when practicable, to have two rooms, one for night, the other for day use, and even for alternate use during the day, so that one can always be freely ventilated when the other is occupied. Only in exceptionally fine weather is it wise to allow a child out of doors, even for gentle walks, until the stage of decline of symptoms is well advanced. Some relaxation may be made in the case of older children, but at all ages a large amount of rest is an important agent in treatment.

In seeking for **indications for treatment** in this disease, those who have approached this subject with the belief that the *most important* one is to endeavour to exert some *antiseptic* influence over the virus developed by a micro-organism in the air-passages, and possibly in the system, have met with *far better results* than those who have ignored that obvious indication. Even the old and much approved quinine treatment may be regarded as, in fact, antitoxic.

Another indication is to endeavour to render more fluid and less viscid and adherent the expectoration, the bringing up of which, often in considerable quantity, usually terminates the paroxysm. If we lessen the tenacity of this secretion so that it can be readily expelled, we shall thereby shorten the paroxysms of cough and diminish their intensity. A third indication is to quiet nervous excitement and spasm.

The treatment of whooping cough is, then, threefold: (1) Antiseptic, (2) anticatarrhal, and (3) sedative.

(1) Our own experience has convinced us of the great value of **carbolic acid inhalations** in the treatment of this disease. But it is better not to use them at all than to use them, as many do, in a wholly inadequate manner. The child or children should be placed in a small or moderate-sized bedroom containing an open fireplace; a large iron dripping-spoon should be kept by the fireside and made hot from time to time, and carbolic acid vaporised by putting a teaspoonful or two into the heated spoon. The room thus soon becomes filled with carbolic vapour.

The nurse should be instructed to keep up this impregnation of the atmosphere with carbolic acid fumes night and day. Moreover, for *direct* inhalation we use, every hour or two, for fifteen minutes at a time, a spray of 1 dram of glycerine of carbolic acid and 10 grains of sodium bicarbonate to each ounce of hot water. However young the child may be, there is no difficulty, except with very nervous, easily frightened children, in keeping this spray playing in front of his mouth and nose, so that he is compelled to inhale it (as shown in Fig. 21, p. 595). In addition to this we cause a warm spray of a 5 per cent. solution of carbolic acid to be frequently diffused through the air over and around the patient's bed. A large Siegle's steam spray-producer, or some modification of it, should be employed for this purpose.

Of this method Oertel says: "I have tried carbolic acid, and certainly obtained more favourable results than with the methods hitherto employed. The youngest of these patients was my own little daughter, $1\frac{1}{4}$ years old, who was laid low by the most violent symptoms, rapidly succeeding paroxysms and fits of coughing. Inhalations of a 5 per cent. solution of carbolic acid were ordered in the following manner:—A small space about 1½ metres in diameter in the child's room was shut in by Spanish screens, and washstands hung with carpets and cloths; the child and her nurse were placed in this, and a 5 per cent. solution of carbolic acid was pulverised for an hour, at a distance of about one metre. The treatment was repeated four times in the day, while the child was kept the rest of the time partly in the same space, partly in the same room. On the first day of the inhalations the symptoms increased, and on their second reached their climax. From that time there was a rapid decrease of them; the paroxysms diminished in number and in violence; the frequent vomiting which had already disturbed the child's nutrition became less frequent, and disappeared, together with the paroxysms, after eight days' steady application of the inhalations of carbolic acid."*

The urine should be regularly inspected, and if any discoloration occurs the inhalations should be suspended for twenty-four hours. Some prefer to diffuse through the apartment the vapour of oil of eucalyptus, or turpentine, or tincture of benzoin.

Albo-carbon, a preparation of naphthalene sold in balls or short sticks, has in our hands proved of great value for impregnating the air of the sick-room. This is vaporised by the heat of a cresolene lamp; or if this is not available we may use a small saucepan over any convenient source of heat. If the lamp is used it should be placed in a basin, and only just enough heat used to melt and vaporise the albo-carbon: otherwise it is liable to catch fire and burn with a smoky flame. The room should be impregnated with the vapour. In a mild case it should be used for two hours during the day and two hours at night. In a severe case we may vaporise the drug for twelve hours out of the twenty-four, in periods of two hours at a time. If brought into use at the very commencement of the disease very few severe cases will be met, and at times in cases of great severity marked improvement will be noted within twenty-four hours of its use.

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* Oertel's "Respiratory Therapeutics," Ziemssen's "Handbook of General Therapeutics," vol. iii., p. 321.

Dr. Suckling and others have given carbolic acid *internally* with good results. Suckling says the duration of the attacks has been shortened by one-half. He gives half a minim with three minims of glycerine in a little peppermint water for a child a year old, and increases the dose with the age of the child.

We give sodium benzoate internally in combination with sodium bicarbonate and ammonium chloride; this mixture exerts a very favourable effect on the paroxysms of cough, and renders the expectoration less tenacious and more fluid. The following is the formula we use:—

℞	Sodii benzoatis	gr. lxxij.
	Sodii bicarbonatis	gr. xlviij.
	Ammonii chloridi	gr. xxiv.
	Aquæ chloroformi	℥j.
	Aquæ anisi	ad ℥iij.

Misce, fiat mistura. One to four teaspoonfuls, according to the age of the child, in a little hot milk, every four hours.

Professor Widerhofer, of Vienna, uses inhalations of solution of quinine (40 grains to 3 ounces of water), as well as inhalations of carbolic acid, and he also has the throat painted with a 5 per cent. solution of hydrochloride of cocaine, which he considers especially serviceable in allaying the tendency to vomit. Quinine *internally*, in full doses, has also been found to shorten the course of the disease. Its use is warmly commended by many authorities. Sticker, of Giessen,* places it foremost of all the remedies for whooping cough. He would give a grain and a-half three times a day to a child a year old, and twice as much to one two years old, and would increase the dose in the same proportion with the age of the child. He recommends the hydrochloride on account of its solubility, but we would advise the substitution of quinine ethylcarbolate (*euchinin*), which is as efficacious, and, being tasteless, can be readily given to children mixed with a little syrup and water, and if followed by a drink of lemonade the acid in the latter will promote its solution in the stomach. It should be given immediately after a paroxysm, so as to avoid its rejection by vomiting. Insufflations of quinine into the throat and nose are recommended by Professor Norman Bridge.* His formula will be found at the end of this chapter. Professor Monti, of Vienna, claims that great service is rendered by an inhalation of a 1 per cent. solution of carbolic acid, and he also uses inhalations of tar-water and sulphurous acid fumigations. The latter have been recommended by many. The patient is removed from his bedroom in the morning, and sulphur is burnt in it in the proportion of 6 drams per cubic yard, the corridors and doors being kept shut for five hours. The room is freely ventilated till the air can be breathed with safety; the child, in fresh clothes, is then brought back to the room and put to bed. It is said he sometimes awakes cured the next morning. Bichloride of mercury sprays have been used, 1 in 2,000, and a 2 per cent. solution of *resorcin* or very weak solutions of *formalin* have been highly spoken of, but they have a limited field of application, because of their liability to excite a paroxysm during administration.

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* Nothnagel's "Encyclopædia of Practical Medicine," English edit., art. "Whooping Cough," 1902.

Bromoform is an antiseptic fluid which has been highly recommended in the treatment of this affection. Senator, Löwenthal, and others speak most highly of its effects. It is given in doses of from 1 to 4 drops, thrice daily, to children a year old; from 3 to 4 drops, three or four times a day, to those from two to four years of age, and from 4 to 5 drops to those from four to eight years of age, according to the frequency of the paroxysms. Care must be taken to keep the drug in the dark, in well-stoppered bottles, as it is decomposed by exposure to sunlight, and then becomes useless. It is stated to diminish the frequency and severity of the paroxysms, to prevent vomiting, and to shorten the duration of the disease. Our own experience of its use does not justify these encomiums. Owing to its being a heavy, oily liquid, not miscible with water, accidental administration of an overdose has occasionally occurred. This risk can be avoided by giving it in an emulsion and shaking the bottle well before it is given to the patient. Martindale recommends the following formula :—Bromoform, 30 minims ; tincture of senega, 3½ drams ; syrup of orange, ½ an ounce. Shake well and add water gradually to 6 ounces. The dose of this mixture is 2 to 4 teaspoonfuls.

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 296.

(2) *Anticatarrhal*, like *sedative*, remedies are only directed to the relief of symptoms.

The benzoate of sodium mixture which we have already formulated is an excellent anticatarrhal remedy, and by facilitating expectoration eases the paroxysms of cough. If the expectoration continues very tenacious notwithstanding, we should add to this mixture small doses, ½-grain and upwards, of potassium iodide. Ems and Bourboule waters are very useful expectorants in the catarrhal stage which usually follows, for a time, the cessation of the paroxysmal attacks. A tablespoonful or more with an equal quantity of hot milk should be given three times a day. Bamberger recommends that some sodium bicarbonate should be dissolved in hot water sweetened with sugar and a mouthful given to the child the moment the attack comes on. If there is any rise of temperature and danger of catarrhal pneumonia in a strong, full-blooded child, Sticker urges the immediate administration of an emetic—a teaspoonful of antimonial wine every ten minutes till it acts—in children under two or three years of age, followed by drinks of hot water. Before the emetic

is given, the bowels should be emptied by an enema.*
In less urgent cases, such expectorants as squill, ipecacuanha, ammonium chloride, and spirit of camphor may be given, and with these small doses of bromide may be usefully combined.

The small ulcers that are formed under the tongue may be painted two or three times a day with glycerine of carbolic acid.

(3) Of the *sedative* agents that have been directed to the relief of the nervous spasmodic element in this disease, *belladonna* is, perhaps, the most popular of all, and has been given in quite large doses. Usually the doses are increased until it causes slight dryness of the throat and flushing of the face. Formulæ for its use will be found at the end of the chapter. Adults may advantageously take *atropine* in its place, commencing with the dose of $\frac{1}{200}$ grain.

But in severe cases the most reliable sedatives in this affection are morphine, chloroform inhalations (which have the advantage of being antiseptic as well as sedative), chloral, and the bromides. Either of these remedies may be combined with others, but they must, of course, be given with great caution.

Morphine must not be given when there is much co-existent bronchial catarrh, lest it should check expectoration, and it should be used only to allay the spasm and nervous restlessness in severe cases, and especially for the nocturnal attacks. The following is a useful combination:—

℞ Morphinæ hydrochloridi	gr. ¼.
Sodii bromidi	ʒss.
Aquæ laurocerasi	ʒij.
Aquæ chloroformi ... ... ad	℥jss.

Misce, fiat mistura. One to three teaspoonfuls for a dose, according to the age of the child.

It may often also be advantageously combined with small doses of tartar emetic.

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* Nothnagel's "Encyclopædia of Practical Medicine," English translation, art. "Whooping Cough."

Or chloral may be given in the following form :—

℞ Chloral hydratis	... ...	gr. xvj.
Sodii bromidi	... ...	gr. xxxij.
Aquæ chloroformi	.. .. ad	℥ij.

Misce, fiat mistura. One to four teaspoonfuls for a dose, according to age.

We can speak highly, too, of a combination of the syrup of codeine phosphate with iodide of soda.

Chloral may also be given in rectal injections. It is perhaps the most useful of all remedies when convulsions occur, and in cases when the sleep is constantly disturbed by paroxysms of cough. Butyl chloral has been given instead in doses of 1 grain every hour.

Chloroform may be inhaled pure from a cone of blotting paper, from 5 to 20 minims at a time, according to age; or it may be combined with an equal part of eucalyptol or spirits of turpentine, and inhaled from the sponge of an oro-nasal respirator.

The application, three times a day, of a 5 per cent. solution of cocaine, brushed over the pharynx, palate, root of tongue, and as low down as possible, so as to allow a few drops of the solution to enter the larynx, if possible, has been found to have a very sedative effect.

The special value of these sedatives is to quiet nervous excitement, and to save the child's strength, which the repeated paroxysms of spasmodic cough tend to exhaust. By thus conserving the child's strength we are adopting the best means of preventing serious complications.

Besides soothing the paroxysms, a great deal may be done to prevent their occurrence. All mental disturbance is prone to provoke an attack, and here a wide field of helpfulness is open to a kind and tactful nurse. Physical effort is another exciting cause. The bed should always be warmed before the child returns to it, so as to avoid contact with cold sheets. All washing of the body surface should be done with water of an agreeable warmth. Sobel claims to have met with much success in controlling and checking the paroxysms of whooping cough by pulling the lower jaw downwards and forwards, so as to overcome spasm of the glottis. Eustace Smith * says that dipping the child's hands into cold water immediately relaxes the glottis. Support to the child by an elastic abdominal belt, or by a broad binder of soft unbleached muslin, will greatly diminish the distressing strain of the cough. Children often pass their urine and fæces during a paroxysm, and the disturbance helps to prolong the attack. This may be diminished by their wearing a diaper, and by the use of draw-sheets to the bed.

The nutrition of the child must be carefully looked to. In the slighter attacks the child will usually be able to feed well in the intervals of the paroxysms, and it will only be necessary to see that its food is light, wholesome, and easy of digestion. Food is best given in small quantities and often, so that advantage may be taken of favourable opportunities as they offer. Milk, milk puddings, Horlick's malted milk, custard, broths, and jellies are all suitable for young children. Older children may be permitted pounded fish or meat, and a little stewed fruit as well. But when the paroxysms of cough are frequent, and attended almost always by vomiting, to maintain the nutrition of the child may be difficult.

The food must then be fluid, and it may be desirable to give it peptonised. A draught of peptonised milk with a few drops of brandy in it may be given immediately the vomiting attending the paroxysms is over; there will be a better chance of its being retained if given immediately on subsidence of an attack.

Albumen water, white wine whey, the juice of a half-cooked steak, may all be tried in turn. The

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* Allbutt's "System of Medicine" (1906), vol. ii., p. 585.

juice of a sweet orange may be kept handy in a cup, so that the child may sip it from time to time.

Small doses of cocaine, $\frac{1}{6}$ grain, twice a day, have been recommended for troublesome vomiting, but this drug must be given cautiously to children.

In protracted cases, and when the season is suitable, no measure answers better than change of air—change from the town to the country or to the seaside. In mild cases, and when there is not much bronchial catarrh, and in fine weather, out-of-door exercise may be permitted and encouraged. But on the occurrence of any rise of temperature the child should at once be kept in bed and carefully watched.

Some cases seem to be prolonged by the presence of adenoids or enlarged tonsils, and the removal of these will then expedite a cure. Syrup of phosphate of iron, cod-liver oil, Scott's emulsion, or one of the numerous preparations of malt, will all be found useful during convalescence.

With regard to prophylaxis, the only effectual prevention of the spread of the disease is isolation. As some children are often well and active in the intervals between the paroxysms, and as out-of-door exercise is frequently permitted, to maintain effectual isolation becomes extremely difficult or impossible. In these circumstances it is best that delicate and susceptible members of the family should be kept away from the patient, by removal from home, if possible. The sputum or vomit should be received in an unbreakable enamelled iron vessel containing some disinfecting fluid, and then poured into boiling water and buried; or it may be received on sawdust and burnt. Soft paper handkerchiefs, that can be burnt, should be provided for cleansing the nose and mouth. It must be borne in mind that a child is not considered free from infection until five weeks have elapsed from the onset of the characteristic cough, and at least two weeks from its disappearance; and then it must be understood that the patient and his clothes have been disinfected.

It is most important not to overlook these conditions in advising *change of climate*, otherwise we may make ourselves responsible for the spread of the disease. The proper period of *quarantine* is twenty-one days after assumed exposure to infection, with the understanding that disinfection has been attended to at the commencement of isolation.

ADDITIONAL FORMULÆ

Sulphur mixture for internal use in diphtheria

Precipitated sulphur, 3 drams
Chocolate powder, 2 drams.
Oil of cinnamon, 2 or 3 drops.
Glycerine to 6 oz.

One or two teaspoonfuls for a dose. (*Knaggs.*)

Perchloride of mercury mixture for internal use

℞ Hydrargyri perchloridi, gr. $\frac{1}{5}$.
$\left.\begin{array}{l}\text{Sodii chloridi}\\\text{Pepsinæ}\end{array}\right\}$ āā gr. j.
Tincturæ aconiti, ♏xv ad ♏xxx.
Aquæ destillatæ, ℥iv.

M. f. mist. A tablespoonful every hour. (*Robbe.*)

For internal use

℞ Acidi salicylici, ʒj ad ʒij.
Gummi tragacanthæ, ℥j.
$\left.\begin{array}{l}\text{Syrupi simplicis}\\\text{Aquæ floris aurantii}\end{array}\right\}$ āā ℥ss.
Aquæ destillatæ ad ℥viij.

M. f. mist. A tablespoonful every two hours (alternately with perchloride of iron, if necessary).

Local application

℞ Acidi salicylici, gr. xx.
Spiritus vini rectificati, ʒjss.
Glycerini, ℥jss.
Infusi eucalypti ad ℥iv.

M. f. pigm. To be frequently applied with a brush.
(*Jules Simon.*)

Ointment for nasal diphtheria

℞ Sulphuris sublimati, ʒj.
Adipis ad ℥j.

To be applied as high as possible after irrigation with boric acid solution. (*Jules Simon.*)

Glycerole of carbolic acid and camphor for local application in diphtheria

Shake together a mixture of
2 drams of carbolic acid,
8 drams of camphor,
10 drams of glycerine,
and place it in a bath of boiling water for ten minutes. Allow to cool. A white, viscid liquid separates and accumulates on the surface. This is the glycerole of phenol and camphor. It has a powerful destructive action on the virus of diphtheria.

It may be applied once or twice a day to the throat, after the false membrane has been removed as completely as possible with a plug of cotton-wool; at the same time free irrigations of the throat should be made every hour with carbolic or naphthol water.
(*Chantemesse and Widal.*)

Gargle of lactic acid

℞ Acidi lactici, gr. cl.
Syrupi aurantii, ℥j.
Aquæ ad ℥viij.
M. f. gargar. (*Le Gendre.*)

Application of carbolic acid and camphor

℞ Acidi carbolici, gr. lxxx.
Camphoræ, ʒv.
Olei olivæ, ℥j.
M. (*Soulez.*)

Naphthol camphor for local application

℞ β-Naphthol, ʒj.
Camphor, ʒij.
M. (*Bouchard.*)

Belladonna and quinine powders for whooping cough

℞ Pulveris radicis belladonnæ, gr. jss.
Quininæ sulphatis, gr. viij.
Sacchari albi, ʒss.
M. et divide in pulv. x. One three times a day.
(*Widerhofer.*)

Spray for whooping cough

℞ Cocainæ hydrochloridi, gr. x ad gr. xv.
Potassii chloratis, gr. iij.
Aquæ ad ℥jss.
M. f. sol. To be sprayed into the throat twice a day.
(*Græffner.*)

Insufflation for same

℞ Pulveris benzoini } āā gr.
Bismuthi salicylatis } lxxv.
Quininæ sulphatis, gr. xv.
M. f. pulv. For insufflation.
(*Moizard.*)

Another

℞ Quininæ hydrochloridi, gr. x ad gr. xx.
Sodii bicarbonatis, gr. xx.
Pulv. acaciæ gummi, ʒiij.
M. f. pulv. A few grains to be insufflated into the throat twice or thrice daily.
(*Norman Bridge.*)

Liniment for the chest during convalescence

℞ Olei eucalypti } āā
Linimenti camphoræ } ℥ij.
Olei cajuputi, ℥ss.
Olei menthæ piperitæ, ʒij.
M. f. linimentum. (*Whitla.*)

Chloral and bromide mixture

℞ Chloral hydrate, gr. xv ad gr. xlv.
Potassii bromidi, gr. lxxv.
Syrupi aurantii, ʒiij.
Aquæ destillatæ, ℥ij.
M. f. mist. A teaspoonful every two hours. (*Widerhofer.*)

Benzoate of sodium mixture

℞ Sodii benzoatis, gr. lxxv.
Syrupi aurantii, ℥j.
Aquæ ad ℥iv.
M. f. mist. A tablespoonful every hour. (*Letzerich.*)

Carbolic acid and iodine mixture for whooping cough

℞ Acidi carbolici, gr. xv.
Spiritus vini rectificati, ♏xv.
Tincturæ iodi, ♏x.
Tincturæ belladonnæ, ♏xxx.
Syrupi papaveris, ʒijss.
Aquæ menthæ piperitæ ad ℥ij.
M. f. mist. A teaspoonful every two hours, between one and two years of age; half the quantity diluted with water for infants under a year. (*Rothe.*)

Mixture for whooping cough

℞ Extracti cannabis indicæ, gr. xij.
Extracti belladonnæ, gr. vj.
Spiritus vini rectificati } āā
Glycerini } ʒjss.
Aquæ ad ℥iij.

M. f. mist. Half a teaspoonful to two teaspoonfuls for a dose, according to age, night and morning. (Not to be given to children under eight months.) (*Vetlesen.*)

Another

℞ Extracti belladonnæ liquidi, ♏iv.
Potassii bromidi, gr. xlviii.
Glycerini, ℥iij.
Aquæ destillatæ ad ℥iv.

M. f. mist. Two teaspoonfuls every four hours. (*Penrose.*)

Mixture for whooping cough with profuse secretion

℞ Extracti belladonnæ, gr. viij.
Extracti conii, gr. iii.
Acidi tannici, gr. v.
Infusi senegæ, ℥ij.
Aquæ fœniculi, ℥j.
Syrupi aurantii floris, ad ℥iv.

M. f. mist. Two teaspoonfuls every two hours. (*Bouchut.*)

Syrup for whooping cough

℞ Extracti belladonnæ, gr. iij.
Syrupi papaveris } āā
Syrupi aurantii floris } ℥j.

M. f. syrup. A teaspoonful night and morning. (*Archambault.*)

CHAPTER III

TREATMENT OF THE ERUPTIVE FEVERS—SMALL-POX—SCARLET FEVER—MEASLES—RÖTHELN TREATMENT OF ERYSIPELAS

Small-Pox—Prophylactic Measures during an Outbreak—Quarantine—Isolation—Disinfection—Varioloid—*Indications for Treatment*, mainly Symptomatic, during Period of Incubation—Vaccination—Treatment of the Initial Stage—Of the Eruptive Stage—Of the Suppurative Stage—Of the Stage of Regression—Complications—Convalescence.

Scarlet Fever—Prophylactic Measures—Tenacity of the Infection—Antiseptic Inunction of the Patient—Disinfection of the Throat—*Treatment of Mild Cases*—Serum—Diaphoretics—Aconite—Feeding—*Treatment of the Severe, Malignant Forms*—Indications—Methods of reducing Hyperpyrexia—Stimulants—Complications—Their Treatment—Otitis Media—Glandular Enlargements—Rheumatic Pains—Nephritis.

Measles—Characters of the Disease—Symptoms—Varieties—Complications and Sequelæ—*Treatment of Mild Forms*—Diaphoretics—Cleansing of Mouth—Itching of Skin, etc.—*Treatment of more Severe Cases*—Of Respiratory Complications—Of Nervous Symptoms—Otitis—Epistaxis—Rötheln.

Erysipelas—Nature of the Disease—Invasion by Streptococci—Etiology—Clinical Course and Characters—Tendency to Recurrence—*Treatment*—Prophylaxis—Local Measures—Mechanical Pressure—Protection from the Air—Ichthyol—Dusting Powders—Antiseptics—Internal Remedies—Iron—Quinine—Sodium Salicylate—Sedatives—Digitalis, etc., in Threatened Cardiac Failure—Serum Treatment.

Additional Formulæ.

Small-Pox

We shall, in dealing with the treatment of this disease, first describe, as briefly as possible, those **prophylactic** measures which are needed when dealing with an actual outbreak of the malady.

On the occurrence of a case of small-pox in a family, all the members of the household should be revaccinated if they have not been recently vaccinated, and the patient should be removed to a small-pox hospital. Anyone who has been exposed to the infection should be quarantined for sixteen days from the date of exposure, and submitted to thorough disinfection at the commencement of that period. Twelve days may be roughly estimated as the *incubation* period of the disease. A suitable place for quarantine must be found, whenever there is an outbreak of the disease, and also fit accommodation in hospital for those attacked.

In this connection we must not fail to take account of the fact that the contagium of small-pox is *volatile*, and that the specific agent in the effluvia from the patient can mingle with the atmosphere around and so infect the air at a distance. This danger is naturally increased when many patients are crowded together and in advanced stages. What has been aptly termed the "striking distance" has in some instances proved considerable, varying with the force and direction of the wind. In an outbreak in Sheffield it was traced to a circular distance of 4,000 feet from the hospital, and a similar fact was established at Bradford.* The contagium has also great vitality, and will cling with great tenacity to articles of clothing, and especially to things of loose texture and rough surface.

In places where a small-pox hospital does not exist, **isolation** of the patient must be carried out in his own home, and in the following manner. Only those who have been recently vaccinated, or who have had small-pox, are suitable as nurses. A room on the upper floor is preferable both for ventilation and isolation. All carpets and hangings and unnecessary articles of furniture should be removed. A sheet wrung out in a strong solution of carbolic acid, or some equally efficacious disinfectant, should be suspended across the doorway. Pieces of blotting paper soaked in eucalyptus oil may be placed about the room, not for the purpose of disinfection, but to cover the unpleasant odour that arises from a small-pox patient; or powdered camphor, or spirits of turpentine, may be sprinkled about the apartment.

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* Nothnagel's "Cyclopaedia of Practical Medicine," art. "Variola," by Zimmermann, English translation, 1902.

It is not desirable that the unaffected members of the household should remove elsewhere, lest they should, perchance, become the foci of infection in other districts. They must rely on re-vaccination, isolation of the affected member or members, and thorough disinfection. The house and the room occupied by the patient should be kept freely, but cautiously, ventilated. An open fire in cold weather is very useful for this purpose, and also for the immediate destruction by burning of certain infected substances. All the excretions, all the discharges, including those from the mouth and nose, should be received in vessels containing some disinfectant, such as corrosive sublimate (1 : 1,000), chloride of lime (10 per cent. solution), or carbolic acid (1 in 20), and, when practicable, should be buried deep in the ground, and not thrown into sewers or waste-pipes. Handkerchiefs, towels, bed-linen, blankets, and clothing, and everything that has come into contact with the patient, should be plunged into water containing chloride of zinc (2 fluid ounces to the gallon), or carbolic acid (4 fluid ounces to the gallon), and, after remaining there for some time, should be boiled for at least half-an-hour in plain water. Most strong antiseptic solutions tend to discolour linen, so that it is well to use old sheets and pillow-cases. Mattresses and pillows should be baked in a disinfecting oven, or treated with steam under pressure. Small articles, such as bits of cotton-wool, lint, sponges, as well as books, papers, etc., should be burnt as soon as used. All earthenware, glass, or metal vessels used in the room should be cleansed in boiling water before being taken out of the room. No domestic animal, nor any person, except the nurses, should be allowed to enter the room. The attendants should wear over-garments that can easily be cleansed and disinfected, and on leaving the patient they should take a bath with carbolic soap freely used, and wash the hair with a weak solution of corrosive sublimate. Nothing that has been in the infected atmosphere should be worn or carried away from the premises without first being disinfected. The medical attendant should also be careful not to remain longer than is absolutely necessary with the patient, and he should not make unnecessary detailed examinations. He should pass into another apartment to give his instructions. He should also take care that both his person and his clothing are thoroughly disinfected before visiting other patients. When prolonged examinations are needed, an outer garment of mackintosh, fitting close round the neck and wrists, should be worn in the sick-room, and hung up immediately outside it.

The patient, when convalescent, must not be allowed to rejoin his family until every scab has disappeared and the skin lesions have all healed, and until he has had two or three antiseptic baths—sponging the body and hair with a 1 in 60 carbolic acid solution, and afterwards bathing in plain water, using carbolic soap freely. In this connection it is important to note the condition of the soles of the feet, where, owing to the thickness of the epidermis, the scabs linger longest. We may sometimes be able to hasten their removal by soaking them in hot soap-suds, and then vigorously rubbing with a rough towel. The clothes the patient wears should be new or free from any trace of infection. In case of death, the body, which remains highly infective, must be washed with a strong chloride of lime or sublimate solution and enveloped in a sheet saturated with one of these, and then placed in a hermetically sealed lead coffin. Disinfection of the sick-room, after recovery or death, is very important. Small things of little value had best be burnt. Whatever will bear prolonged immersion in boiling water, or exposure to steam at, or over, a temperature of 212° F., may be purified by this means ; or exposure to a dry heat of 230° F. for two hours will suffice.

The apartment itself and the heavy furniture and any clothes may be disinfected by formaldehyde gas. This is readily produced by volatilising formalin or paraform tablets over a lamp. An excellent model for the purpose is the Alformant "A" lamp.*

In the absence of any special apparatus the gas may be generated by mixing commercial permanganate of potash with 40 per cent. solution of formalin in a tin dish. Six and a half ounces of permanganate are first put into the dish, and then a pint of the formalin solution is poured over it; this will suffice for a room of 500 cubic feet, and for larger rooms the amounts must be proportionately increased. Every preparation must be made to quit the room immediately the formalin solution is added, as evolution of gas commences at once. The room should be kept closed for twenty-four hours, then opened and thoroughly ventilated. All surfaces should be washed with disinfecting solution (sublimate 1 in 1,000, or carbolic 1 in 50), and afterwards the floor and woodwork scrubbed with soap and water. The ceiling and walls must be whitewashed; or, if papered, the paper should be soaked first with carbolic solution, and then scraped off and burnt; or the walls may be rubbed with slices of new bread. The room had also better be kept open to the air and unoccupied for some weeks. These are the chief measures to be attended to in order to prevent the spread of this disease.

Vaccination has certainly modified greatly the type of this disease even where it has not conferred immunity, and the form known as *varioloid* is commonly met with. The mildest cases of this form really require no treatment beyond hygienic measures. The severer forms, however, may approach very closely in characters those of the unmodified disease, and must be, of course, treated in the same manner; and, as in certain places the so-called "conscientious objectors" are numerous, in any extensive outbreak of this disease a considerable number of severe and fatal cases occur. The last epidemic in London (1902) was fatal to a number of vaccinated as well as unvaccinated patients, and the necessity for *re-vaccination* has been amply demonstrated.

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* Sold by the Formalin Hygienic Company, Ltd., 3, Lloyd's Avenue, London, E.C. Formalin tablets and full directions for use are supplied along with it.

It would be out of place to dwell here in detail on the technique of *vaccination*, a practical acquaintance with which is now happily demanded by every examining Board.* We consider, however, that sufficient stress is not laid on the fact that the complications that have done so much to bring vaccination into disrepute are most of them avoidable, if it is understood that they are all, or nearly all, due to intercurrent infection with pyogenic organisms. Part of the blame must be laid to the charge of our present supply of lymph, as even the best specimens of glycerinated lymph are not free of all extraneous germs. The problem of the day is to ensure sterilisation. Vapour of chloroform has been employed in place of glycerine for this purpose, but we have not yet any proof of its greater efficacy. Nor as a rule is sufficient care taken to obtain surgical cleanliness of the arm before inoculation, nor to maintain asepsis thereafter. It is better in all cases to wash the arm thoroughly with soap and water, followed by some weak antiseptic, which in turn must be removed by sterilised water: the lancet also should be boiled before use. The inoculated areas should be protected with a dressing of sterile wool or gauze, which should not be allowed to slip out of position, or, if it does so, should be replaced at once. If these simple precautions are unfailingly carried out, it is surprising how few "bad arms" are seen. When such occur, the local inflammation and œdema will usually subside rapidly under the soothing influence of a succession of hot boracic fomentations. We are satisfied that these in no way interfere with the efficacy of the vaccination. In the case of the more serious forms of erysipelas and cellulitis, which fortunately are very rare, anti-streptococcic serum should be administered without delay, along with appropriate local treatment.

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* "The vaccine must be kept in as cold a place as possible, a temperature below 10° C. being almost essential. Vaccine carried on the person, placed on a shelf near a fire or any other source of heat, will soon begin to deteriorate in potency. It is also highly desirable that the vaccine be not exposed to bright light."—Lister Institute "Notes."

It is somewhat remarkable that in this, the type of a contagious disease, the infective agent has not yet been identified and isolated, nor have we any medicinal agents by which its activities can be neutralised or destroyed. It is no doubt parasitic, and Guanieri and Councilman and others have identified parasitic bodies in the epithelial cells of the lesions, which in all likelihood are the causal agents: entrance into the body is most probably by inhalation through the mouth and nose. The **treatment,** therefore (apart from prophylaxis), is symptomatic, and the indications are to maintain the strength of the patient, and to impose such favourable modifications on the course and symptoms of the disease as may be within the scope and power of the means at our disposal.

With regard to treatment during the period of **incubation,** very conflicting opinions have existed as to whether vaccination, performed at any time during this period, can partially or completely protect the patient from the disease, or favourably modify its course. W. H. Welch, of Philadelphia, and H. Immermann, of Basle, recent authorities on this subject, maintain that it certainly can.* Welch states that he has seen many cases of small-pox which have been very greatly modified by vaccination performed during the period of incubation, and some instances in which the disease has been absolutely prevented. For complete protection he found it necessary that vaccination should be performed "immediately after the reception of the contagium; but, if made at a somewhat later date, a modifying effect may be obtained. No part of the incubation period should be considered too late to make use of this remedy." He thinks that vaccinia only begins to exert prophylactic power when the areola commences to form around the vesicle. "If this stage of the vesicle be reached before the patient shows any symptom of small-pox, the disease may be entirely prevented; if not reached until after the febrile symptoms appear, but before the eruption occurs, it may modify the attack; . . . if vaccination be practised on the first or second day after the reception of the infection, the protection may be perfect; and if employed between this date and the fifth day, it may be partial." As the incubation period of small-pox is usually as much as twelve days, vaccinia may be completely developed between infection and the onset of symptoms. Different individuals acquire immunity with varying rapidity, and likewise retain it for varying periods. Welch also gives reasons for concluding that humanised virus is much more protective than animal lymph, and he prefers "eight-day lymph taken directly from a typical vaccine vesicle on the arm of an infant." He also insists that a considerable number of insertions should be made in order to lessen the risk of failure, and to hasten the attainment of the prophylactic stage. He objects to bovine lymph because of the relative slowness with which it reaches the areola stage. Of 194 cases in which he performed vaccination after infection, 38 enjoyed complete protection, 16 were almost completely protected, 31 were protected to a well-marked degree, 30 were partially protected, and 79 were unprotected.

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* Dr. W. H. Welch, Physician to the Municipal Hospital for Contagious and Infectious Diseases, Philadelphia: Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 105; and Immermann, in Nothnagel's "Cyclopædia of Practical Medicine," art. "Vaccination."

As we have indicated above, immunity by vaccination is a wasting security. Children vaccinated in the first few months after birth should be revaccinated at seven, fourteen and twenty-one years, and in the face of an epidemic even at shorter periods, as some subjects rapidly lose their immunity. After twenty-one years, up to the end of life, vaccination is usually dispensed with, except in face of the prevalence of small-pox, when it will be wise to undergo fresh vaccination, if more than seven years have elapsed; in such a case the inoculation will probably not "take," so that the maintenance of immunity may be tested at a minimum risk of resulting discomfort.

In the **initial** stage, the febrile stage that precedes the appearance of the eruption by about three days, the patient should be kept in bed in a room the temperature of which should be from 65° to 70° F., with a space of not less than 2,000 cubic feet, and means of free ventilation without exposing him to chilling draughts. Some saline diaphoretic should be given, and preferably in effervescent form, such as

℞	Ammonii carbonatis	gr. v.
	Potassii bicarbonatis	gr. xv.
	Liquoris ammonii acetatis	ʒij.
	Syrupi aurantii	ʒj.
	Aquæ	ad ℥iss.

Misce, fiat haustus. To be taken every four hours in effervescence with 15 grains of citric acid. Half this dose may be given to children.

In this and subsequent stages the depressing antipyretic drugs should be avoided, as they are more likely to do harm than good.

If there should be sickness, which is not rare with children, fragments of ice with a teaspoonful or two of lime water may be given frequently. A high temperature, with a hot and dry skin, may be treated by sponging with tepid water; and severe headache, by the application to the head of an ice-bag or of lint dipped in iced water.

Severe *pain in the back*, together with *restlessness*, *insomnia*, and other nervous symptoms, may appear in this stage. In children delirium and convulsions may occur. The best remedy for these symptoms is a prolonged lukewarm, full-length bath, followed by a dose of Dover's powder (1 to 5 grains for a child, according to age, and 12 grains for an adult); or a combination of chloral and sodium bromide may be given for the nervous irritation and sleeplessness. Should it be difficult to give medicines by the stomach on account of sickness, a morphine suppository may be used; or a small enema of bromide and chloral may be given. Mustard plasters to the back or elsewhere are obviously undesirable, and for the relief of the backache other measures have been suggested. A succession of hot linseed-meal poultices may be applied to the back: or a mixture of chloroform liniment and soap liniment may be rubbed in; some recommend dry-cupping, or the application of an indiarubber hot-water bag, and others a few small doses of antipyrin. Cooling acidulated drinks may be freely permitted. The food should be light and fluid, such as milk and light animal broths. A little tea may also be allowed to adults. The bowels must be kept relieved by gentle aperients. If signs of cardiac weakness should appear at this early stage, which is rare, caffeine may be given hypodermically.

The treatment of the **eruptive** stage must next be considered. This stage usually lasts seven or eight days, but in the modified varioloid it may not last so long. Attempts have been made to abort the evolution of the lesion by means of a serum derived from immunised calves, but the procedure has not met with any measure of success. When the eruption is copious it will add to the comfort of the patient and facilitate the treatment of the eruption if the hair is cut close. Various *antiseptics* have been used in this stage, both externally and internally, with the hope of modifying the severity of the eruption and preventing pitting, but it cannot be said that any marked success has attended their use. Some benefit has been claimed to follow the use of sulphur, a drug which is, in part, eliminated by the skin, and may therefore exert a local action. The following mixture has been prescribed for children :—

℞ Sulphuris loti	ʒijss.
Syrupi simplicis	℥j.
Glycerini	℥jss.
Aquæ aurantii floris ... ... ad	℥v.

Misce, fiat mistura. A teaspoonful every hour.

Moderate doses of quinine, perseveringly given, dissolved in lemon-juice and water, we should strongly advocate. Bianchi has employed antiseptics locally with good results. He uses a boric-acid bath with antiseptic soap every four hours. After the bath an iodoform and vaseline ointment is applied (1 to 5 per cent.). The pustules, where possible, are opened with an aseptic needle, and the patient is wrapped in aseptic linen which is frequently changed.

Immermann * is inclined to think that none of these measures affords greater relief than the plan advocated by Von Hebra for quieting the patient and alleviating the discomfort and tension of the eruption by the frequent repeated application of moist cold, in the form of ice-water compresses or moist cold packs. As the eruption advances towards suppuration the water may be used warmer and the compresses may be covered with a waterproof protective covering. Later on, when suppuration has occurred, some disinfectant may be added to the water, such as carbolic acid or thymol or Condy's fluid. The head and face and hands and feet may still have the ice-cold application, which exerts an antipyretic influence.

It has been stated that if the **ultra-violet rays** are intercepted by means of tightly-drawn red curtains, or red window-panes, in the patient's room, the injurious effect of the sunlight on the skin will be avoided, and patients are said to have escaped the suppurative stage and avoided scarring when kept in a room the windows of which were covered with thick red woollen curtains. This treatment with red light has, however, been tried by several independent observers with negative results. At the Clinique in Lyons some of the patients became very excited and begged to be placed in ordinary light; indeed, the red light proved very trying both to patients and to attendants.

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* Nothnagel's "Cyclopædia of Practical Medicine," English translation, art. "Variola," 1902.

The fever usually lessens after the appearance of the eruption, but increases again with the onset of the suppurative period. If the eruption is tardy in its appearance, warm stimulating drinks should be given to promote its full development. The condition of the mouth and throat, which is often very distressing, requires some attention. Mouth-washes of borax and boric acid, or of potassium chlorate, to which a little tincture of myrrh is added, are very comforting, and they may be used warm. Some prefer weak solutions of ferric perchloride. In young children these solutions may be sprayed into the mouth and throat, or the nurse may wash the mouth with her finger covered with lint dipped in them, but by none of these methods can we get the complete cleansing afforded by irrigation of the mouth with a syringe. Ice-cold compresses round the neck are also recommended. The burning and itching of the skin may be relieved by the application of ice-cold water in the manner just described; some use a mixture of olive oil and lime water in equal parts, perfumed with lavender water; this should be brushed freely over the skin. Ointments of vaseline, with thymol, or eucalyptol, or carbolic acid, are also serviceable, and are of advantage in lessening the unpleasant odour of the disease. Some use antiseptic dusting powders, as boric acid, carbolised zinc powder, "dermatol," or a mixture of 15-20 parts of aristol to 100 parts of talc. Some apply to the face a light *mask* of lint, well soaked in a mixture of iced-water and glycerine (a dram to the ounce), and cover it with oiled silk.

Ichthyol ointment (1 part ichthyol, 2 parts lanolin, and 6 parts lard) has been warmly commended, applied three times a day, as soon as the papules are visible. It is said to modify favourably the course of the eruption, lessen the fever, and render the whole course of the disease milder. Much pain sometimes attends the development of the eruption in the thick skin of the hands and feet; this is best relieved by hot fomentations.

Towards the latter part of this stage troublesome symptoms of nervous excitement are apt to appear, such as great restlessness, insomnia, and violent delirium. In the robust this condition may sometimes be relieved by a brisk purge and an ice-bag to the head. Of medicinal means morphia is the most reliable and should be given in full dosage. In some cases a combination of tartar emetic and morphine ($\frac{1}{8}$ to $\frac{1}{3}$ grain of each) has been found of great service in quieting delirium and inducing sleep; or full doses of chloral and bromide, largely diluted, may be given by the stomach, or, if necessary, by the rectum. Certain cases are so violent as to need physical restraint.

The food during this stage must be nutritious and easily digested. Animal broths, milk, bread and milk, whipped eggs, are the most suitable. For the *throat* nothing is better than plain water flavoured with a little lemon-juice or raspberry vinegar.

The form known as *hæmorrhagic* or *malignant* small-pox affords little scope for treatment, as it is almost inevitably and rapidly fatal. Quinine, ergot, perchloride of iron, and even transfusion, have been tried, but not with any curative result.—-

By the stage of **suppuration** is meant the period when the eruption becomes mature and the papules and vesicles have developed into pustules. It usually occupies from the eighth to the twelfth day of the eruption, and it is accompanied with the so-called secondary or suppurative fever. This is the most serious, painful, and fatal stage. Often the mouth, throat, and larynx become dangerously involved, swallowing becomes almost impossible, and respiration is greatly impeded. Everything that is possible must now be done to maintain the strength, lessen the fever, relieve the throat symptoms, and disinfect the surface.

In **confluent** cases the temperature at this stage may reach 105° or 106° F. Quinine is one of the best agents for allaying the fever as well as supporting the strength. The dose necessary is not more than 2 or 3 grains, but it must be given in solution, and best in effervescence with potassium citrate, every two, three, or four hours, according to the severity of the fever. Immermann prefers a strong decoction of *cinchona bark*, and this, combined with full doses of alcohol, he considers of undoubted value during the suppurative fever. He gives 2 to 4 ounces of cognac in twenty-four hours, and he likes the brandy-and-egg mixture of the B.P. as a vehicle. The decoction of cinchona bark he gives in combination with dilute hydrochloric acid and spiritus ætheris nitrosi. To allay the high fever of this stage and to quiet the cerebral excitement he speaks very confidently of the value of *lactophenin* (this differs from phenacetin in containing a molecule of lactic acid in place of acetic); he gives it in doses of 7 grains once or twice in the evening. He found it exerted an "extremely favourable" influence both on the fever and the general condition.* Small-pox patients do not bear cold immersion baths well.

The rupture of the pustules covers the surface with a foul, decomposing, fœtid exudation, which dries into crusts for the removal of which baths or moist applications are needed. Every care must be taken to prevent scratching, which increases and disseminates the septic process. When practicable, a full boric acid warm bath should be given daily. Such *antiseptic* washes and sprays as we have already mentioned must now be used freely; none is better than the glycerine and iced-water mixture already mentioned. Some prefer oily appliances, such as the olive oil and lime-water lotion, to which some carbolic acid or eucalyptol may be added (10 to 20 drops to the ounce). Dujardin-Beaumetz strongly recommended an ointment composed of 4 parts of sodium salicylate to 100 parts of cold cream. This is freely applied to the face and other parts affected with the eruption. Welch protests against the use of most of the expedients that have been suggested for the prevention of pitting and scarring, and quotes with approval Gregory's statement that "the masks and ointments formerly in use for that purpose, and so highly vaunted, are, in reality, more hurtful than beneficial. The application of a little cold cream to the hardened scabs is all that can be recommended." We would suggest as a very suitable application to the face during this and the preceding stages an ointment composed of camphor 2 parts, menthol 3 parts, and vaseline 20 parts. The prevention of deep scarring depends on the rapidity with which the lesions can be induced to heal.

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* Nothnagel's "Cyclopædia of Practical Medicine," English translation, art. "Variola," 1902.

At this period of the disease in severe confluent cases the condition of the mouth and throat is such as to cause much anxiety. The mucous membrane of these cavities is often covered with what looks like a diphtheritic membrane, and this may extend into the posterior nares and into the larynx, causing dysphagia and much fœtor of the breath. The disinfecting washes and sprays recommended in the treatment of diphtheria should now be employed. Perhaps the best is a solution of chlorine made by pouring 40 minims of strong hydrochloric acid on 20 grains of powdered potassium chlorate in a 12-ounce bottle, corking the bottle and allowing the liberated chlorine to collect in it, and then filling the bottle, little by little, with water, and shaking at each addition; a very effective disinfecting lotion is thus obtained, with which a few drams of glycerine should be mixed. Or a spray may be used freely to the mouth and nostrils, composed of 1 ounce each of glycerine of borax and glycerine of carbolic acid to 12 ounces of rose water.

The patient should be given iced barley water, with a little glycerine in it, to sip frequently; or small pieces of ice may be allowed to dissolve slowly in the mouth. Œdema of the glottis may threaten suffocation; if ice-cold compresses to the throat fail to afford relief, we must have recourse to tracheotomy, which, it is needless to say, would be performed under very unfavourable conditions. The state of the eyes at this period also requires attention; the lids are usually greatly swollen, and pus exudes from between the closed lids. They should be freely bathed and cleansed with warm boric acid solution, after which the lids should be smeared with vaseline.

The patient's strength during this trying and exhausting period must be maintained by the free exhibition of stimulants and nutritious fluid food. The egg-and-brandy mixture of the B.P. should be given freely and frequently. We have already dwelt on the value of quinine in these cases. Digitalis may be needed in threatened heart-failure, or caffeine, or hypodermic injections of ether, strychnine, or camphor (1 in 5 of rectified spirit or sterilised oil). It is better to keep the bowels unloaded by means of enemata than to give purgatives by the mouth in this stage.

The stage of **regression**, or drying-up and disappearance of the eruption and of the swelling and redness of the skin, usually begins about the eleventh to the thirteenth day. The patient will still require supporting food and stimulants and tonics, of which quinine, with perchloride of iron and strychnine, will be the best. Cooling and soothing antiseptic washes, or ointments, are still necessary to disinfect the decomposing *débris* and exudation which even now cover the skin, and to allay the itching.

The numerous **complications** of small-pox have to be treated on the same general principles as when they occur under other conditions, such as abscesses, erysipelas, gangrene, corneal ulcer, pneumonia, empyema, etc. Corneal ulcer is a very serious complication, and may lead to blindness, and even destruction of the eyeball; it is not due, as has been supposed, to the formation of a variolous pustule on the cornea, which appears to be immune from the small-pox eruption. Welch has observed it begin with "a little pain and slight redness in a certain part of the eye, usually at the margin of the cornea, and very soon an ulcer is formed. The ulcerative process is often very rapid—so rapid, indeed, as to destroy the entire cornea within forty-eight hours." In order to prevent this deplorable complication the eyes must be kept scrupulously clean; a saturated solution of boric acid in rose-water should be dropped into them twice daily. As soon as any sign of ulceration appears the spot should be carefully touched with a finely pointed stick of nitrate of silver; atropine should then be dropped into the eye, and cold compresses kept applied. Opium is often useful; it relieves the pain in the eye, and appears to have a good effect in modifying the ulcerative process.

Tonics, such as quinine and iron, and stimulants, of which good beer or porter is the best, and a nutritious dietary, are needed during the convalescent period; the frequent occurrence of boils during this stage may call for the use of arsenic.

Complete shedding of the crusts is hastened by the free application of glycerine and rose-water (1 : 3) to the skin and the daily use of warm baths.

SCARLET FEVER

As in the case of small-pox, so with regard to scarlet fever, we shall first refer briefly to the necessary **prophylactic** measures which must be adopted in order to prevent the extension of the disease, when we find ourselves in the presence of an outbreak. Much that has been said with regard to the prevention of the spread of small-pox necessarily applies also to the case of scarlet fever. The specific infective micro-organism of scarlet fever has not yet been adequately demonstrated. Klein has found a streptococcus in the blood and in the throat which he regards as distinctive ; but others think it dependent on the *septic* element doubtless present in most grave attacks. Osler mentions that Class of Chicago found a *diplococcus* in the blood, throat, and desquamated cuticle in 300 successive cases, which proved pathogenic to mice, swine, and guinea-pigs. The streptococcus is undoubtedly an active agent in the throat and ear affections.

Scarlet fever is infectious from the first day of its occurrence, but it is impossible to say how long the possibility of infection lasts. The period of isolation after an attack should not be less than six weeks from the first appearance of the rash, supposing the child to be then quite well and free from all discharges from the throat, nose, and ears. Even in the absence of any discharge there is reason to think that these passages may harbour infection, and they should be systematically washed with weak antiseptic solutions for some days after liberation from the sick-room. It is no longer considered necessary to await completion of desquamation, as, though the cuticle in the early stages may almost certainly communicate the disease, it appears later to lose this faculty. The average incubation period is three days, the shortest is two hours, and the longest six days. As a measure of safety, the quarantine period, after exposure to infection, is ten days.

There is this peculiarity about the poison of scarlet fever, that its tenacity is remarkable, and that it adheres to persons and things with great persistence, and is therefore readily conveyed by such means from place to place. Hence it is of the greatest importance that all books, pictures, toys, etc., used by scarlatinous patients should be burnt, and not allowed to pass into the possession or use of other children.

Many months may elapse and yet the infection remain in such objects active and virulent. Epidemics have often been traced to infected milk, but never yet to bad drainage or contaminated water supply. It has been said that the method of disinfecting an apartment by burning sulphur in it, as described in the section on small-pox, is useless, because if, immediately afterwards, the *dust* in the apartment is collected, numerous micro-organisms may be obtained from it. But this is rather a foolish criticism; antiseptic *vapours* are intended to act as *aërial* disinfectants, and not necessarily, at the same time, as destroyers of microbes in deposits of dust. Such deposits must be dealt with in a different manner. Aërial disinfection is not supposed to dispense with the necessity for other methods which are needed to disinfect dust-containing objects, or dust deposits.

We have, in a hospital, used chlorine vapour with absolute success in disinfecting a ward of the infection of scarlet fever, but we have never thought of leaving dust deposits, or articles holding dust, to take care of themselves; they must be dealt with differently. All dust deposits should be gathered up and cleared away by sponges wetted in strong antiseptic solutions, and these should be subsequently burnt, or soaked in boiling water, or exposed to a dry heat of 230° to 240° F.; and all other contaminated articles must be treated as described in the section on small-pox.

Notification of the disease, **isolation** of the patient, **disinfection** of his person, and of those about him, and of the air and the necessary objects in the apartment, is the practice that must be carried out in order to prevent the spread of the disease. In the preceding section on small-pox we have described how this may be done.

As another precaution and as a comforting application, the whole surface of the body of the patient should be sponged once or twice daily with tepid water and subsequently anointed with the following oil :—

℞ Acidi carbolici	ʒj.
Olei eucalypti	ʒij.
Oleum olivæ	ad ℥viij.

Misce.

Some physicians permit a daily warm bath, but in this case great care should be taken to avoid exposure to chill, and a warm blanket should be ready to wrap round the patient on his return to bed. Oily applications to the skin are particularly grateful, to relieve the dryness and itching which often accompanies the rash. Vaseline is used by some, cacao butter by others. Eucalyptus oil has been greatly extolled for this purpose, and the ointment of eucalyptus of the B.P. may also be used. Another soothing application is the following calamine lotion :—

℞ Pulv. calaminæ	℥j.
Zinci oxidi	℥ss.
Glycerini	ʒij.
Aquæ rosæ	ad ℥viij.

Misce, fiat lotio.

But all applications to the skin should be discontinued as soon as irritability is relieved, as it is important not to hamper its excretory function.

In adult patients it is usually necessary to hasten desquamation of the thick skin of the soles of the feet. To this end the soles should be soaked daily in a strong solution of washing soda for ten minutes, and then in hot soap-suds for the same time, before drying them by vigorous rubbing with a rough towel.

As there is almost invariably some local manifestation of this disease in the throat, where not unfrequently patches of false membrane appear, as in diphtheria (which, it must be remembered, occasionally complicates this disease), disinfection of the throat and mouth is also important. By this means also we may be enabled to check the tendency to the extension of the local inflammation, from the throat along the Eustachian tube to the middle ear, as well as the infection of the cervical glands. Antiseptic washes should be frequently used, and formulæ for these will be found at the end of the chapter. We prefer free irrigation by means of a syringe, or sprays from one of the "hand-atomisers" now so largely used, to the use of gargles. Nothing is more efficacious for this purpose, or more beneficial to the disease itself, than the chlorine mixture made according to the formula at the end of this chapter (p. 667). This should be used every four hours as a wash for the mouth and throat, and some of it should be swallowed. Another way of applying it to infants or young children is by means of a rubber enema bottle holding 4 or 5 ounces, with which the nurse should irrigate freely the fauces. Infants or struggling children should be completely wrapped in a rough towel or mackintosh sheet on the nurse's knee so as to control the hands, and protect the neck, shoulders, and arms from wet. A weak solution of formalin (½ per cent.) has been suggested instead of this, but it is not so good. Another suitable lotion is one to which we have formerly called attention—viz. a mixture of 1 dram of glycerine of carbolic acid and 30 grains of sodium bicarbonate to an ounce of warm water. Some prefer a mixture of 1 part of peroxide of hydrogen to 3 or 4 of water: others use acetozone (gr. x) to the pint of water. A borax and boric-acid wash, with a little tincture of myrrh, is also useful for the same purpose, and preferable for cleansing the nasal passages:—

℞ Acidi borici	
Glycerini boracis	℥j.
Tincturæ myrrhæ	ʒij.
Aquæ	ad ℥xij.

Misce, fiat gargarisma.

Nasal irrigation is no less important than irrigation of the fauces. It must be done gently so as to avoid any risk of driving septic material into the Eustachian tube. The strong solutions used for the throat are far too irritating to the sensitive nasal mucosa, and must be replaced by such a lotion as the above, or by simple saline solution.

The physician in attendance should remember that great infectivity attaches to the discharges from the throat, nose, and ears, and that the desquamated cuticle is much more infective during the *early* part of convalescence than later on, and he should be particularly careful that none of the infective virus attaches itself to his clothes or to his person. The precautions necessary in each case, from this point of view, may best be left to the judgment and discretion of the practitioner himself. Non-attendance on midwifery cases while looking after scarlet fever patients is a precautionary measure now universally adopted. We have already given instructions (page 624) for the disinfection of rooms that have been occupied by such cases. The preceding measures are all directed to the limitation and weakening of the infection.

The **indications** for remedial **treatment** in scarlet fever, as in small-pox, are almost wholly symptomatic. Moser prepared a polyvalent antiscarlatinal serum from streptococci taken from cases of scarlet fever, but no substantial benefit resulted from its use. Palmirski and Zebrowski produced a serum from the *streptococcus scarlatinæ* of Klein, and have recorded encouraging results. In the *mildest cases* little is needed in the way of drug treatment. The patient should be in a well-ventilated bedroom at a temperature of about 60° F., but at the same time he should be most carefully protected from cold currents of air and possible chill. A sleeved undervest should be worn beneath a flannel nightgown as a precaution against exposure of the arms, neck, and chest. He should remain in bed until the temperature has been normal for ten days, and for a minimum period of three weeks; this diminishes the likelihood of chill, and at the same time saves the kidneys from postural hyperæmia during the period of chief vulnerability. The change from recumbency to an upright posture should be made gradually, and he should keep his room for the full six weeks. In winter or in cold seasons it will be advisable for him to keep to his room and the house even longer.

We must distinguish, in considering the appropriate treatment of cases of scarlet fever, between the *mild* forms and the *severe* and malignant forms. Although scarlet fever is the most fatal of the infectious fevers, yet different epidemics differ very greatly in their severity. In some the cases assume a very mild form and run generally a favourable course; but even in the mildest cases we can never be sure that some serious complication may not arise. The same careful nursing and medical observation must be given to a mild as to a severe form of this fever. During the period of invasion, which is brief (the eruption generally appears on the second day), after an aperient dose a diaphoretic saline should be given, and if the child is strong and robust, with a rapid, hard pulse and a high temperature, a small dose of aconite may be added. The following mixture will be suitable:—

℞	Liquoris ammonii acetatis	℥jss.
	Potassii chloratis	ʒj.
	Tincturæ aconiti	♏xxiv.
	Syrupi limonis	℥ss.
	Aquæ	ad ℥vj.

Misce, fiat mistura. One to three teaspoonfuls every four or five hours, according to age.

This mixture will tend to promote the development of the rash, and will at the same time allay the feverishness and heat. The aconite should be omitted after the first forty-eight hours, but it has an exceedingly tranquillising effect, in the early stage, in the type of child indicated. We must remember that chlorate of potash in large doses is a renal irritant, and employ it with caution. One grain for every year of the child's age, up to 5 grains, is a safe rule. If there is a thickly-furred tongue and a tendency to vomiting, an effervescing saline with an excess of alkali should be given, and a grain or two of calomel with sugar may be thrown on the tongue; or an aperient dose of Gregory's powder with a grain or two of grey powder may be given. It is well at the outset of all febrile maladies to sweep away any fæcal collections there may be in the intestines.

If the temperature does not rise above 103°, and no very troublesome throat affection manifests itself, little else need be done during the eruptive stage.

During the active period of the disease the food is best restricted to milk, or a mixture of one part of cream to four parts of milk, with the addition of a small quantity of milk-sugar. Some fresh fruit may also be permitted, such as oranges and grapes. After subsidence of the acute symptoms, farinaceous foods, vegetables, and vegetable soups may be gradually added to the milk diet. Not until three or four weeks have elapsed, and in cases with renal complications even later, should nitrogenous foods be permitted, except in the smallest amounts; then one poached egg daily, meat jellies, meat soups, light fish boiled, sweetbread, calves' brains and the like may be permitted. At the New York Scarlet Fever Hospital patients are encouraged to drink water freely throughout the active period of the disease It is claimed that this dilution of the excreted toxines materially diminishes the frequency and severity of renal complications. There eight ounces of milk are given to an adult every two hours from 6 a.m. to midnight, and eight ounces of water every two hours from 7 a.m. to 11 p.m., and to children a proportionately smaller amount. The specific gravity of the urine should be watched daily, and in the absence of dropsy a high specific gravity should be regarded as an indication for increasing the amount of water. After subsidence of the fever quinine and iron may be given to stave off anæmia. The following mixture may be prescribed :—

℞ Quininæ sulphatis	gr. xxiv.
Potassii chloratis	gr. xlviij.
Tincturæ ferri perchloridi	ʒjss.
Succi limonis	℥ss.
Syrupi	℥j.
Aquæ	ad ℥vj.

Misce, fiat mistura. One to three teaspoonfuls, according to the age of the child, three or four times a day.

In the next place we must consider the treatment appropriate to the severe and malignant forms. The **indications** now are: (1) to support the strength of the patient, (2) to deal efficiently with the local manifestation in the throat, and (3) to prevent, if we can, complications and sequelæ.

The condition which threatens to exhaust the patient, probably more than any other, is the occurrence and maintenance of a high temperature, and when the temperature is very high, and remains so, we must do our best to reduce it. The safest and best way of reducing temperature, although it will not always succeed, is to give quinine frequently, either in solution, in the chlorine mixture we have already referred to (p. 640), or in effervescence, as in the following prescriptions. In either manner we should give from ½ to 3 grains, according to the age of the patient and the severity of the case, every two or three hours.

℞ Sodii bicarbonatis	ʒj.
Potassii bicarbonatis	ʒjss.
Potassii chloratis	gr. xij ad xxxvj.
Aquæ	ad ℥xij.

Misce, fiat mistura alkalina.

℞ Quininæ sulphatis	gr. xxiv ad xxxvj.
Acidi citrici	ʒjss.
Syrupi limonis	ʒj.
Aquæ chloroformi	ad ℥xij.

Misce, fiat mistura acida. One or two tablespoonfuls of each mixture in effervescence every two or three hours. The larger dose is for adults. Very young children may take doses of a dessertspoonful.

Quinine given in either of these ways * will be found in most cases to exert a remarkable effect in moderating the high temperature, while we run no risk of producing any depressing effect on the patient, or of determining renal irritation or congestion.

There are, however, other means of reducing temperature in these cases to which it is necessary we should allude. When the high temperature is accompanied by delirium and signs of nervous exhaustion, the cold pack, or sponging with tepid or cold water, may be needful, but scarlet fever patients, for the most part, benefit but little from the *general application* of cold. The *local* application of cold, however, to the *head* and *neck* is often very efficacious in lowering the temperature. The application of an ice-bag to the head, or of pieces of lint or linen soaked in ice-cold water with which a little vinegar and eau-de-cologne have been mixed, is most refreshing ; and at the same time a broad strip of lint, or soft linen, soaked in the same iced water, should be wrapped round the neck and throat and frequently renewed. The temperature may often be reduced by this means if it is perseveringly applied. In a vigorous patient the limbs may also, from time to time, be lightly and rapidly sponged with this cold lotion. The more frequently this is done, the greater will be the effect on the temperature. In cases with feebleness of circulation and general depression, cold must not be applied to the extremities, but rather tepid or even *hot* water, combined with stroking or friction in the direction of the venous blood-current. Sucking fragments of ice or sipping iced lemonade has also a cooling effect, and still more cooling is an ice-cold enema, which may be composed of a few ounces of peptonised milk.

We cannot recommend the employment of the various antipyretic drugs that have been so widely used in the treatment of febrile maladies; there is too great risk of undue depression attending their use. Certainly sodium salicylate, antifebrin, antipyrin, and similar depressors of temperature should be avoided. We have, however, seen good results follow the frequent exhibition of small doses of *phenacetin* in combination with quinine. The dose of phenacetin should not be more than ¼ to 1 grain for children between two and ten years of age. This dose may be given every hour or two, and its effect observed.

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* The antipyretic effect of quinine is much greater, when given in this combination, than when given alone in the solid form. The chloroform water in the acid mixture prevents changes in it which are apt to occur when kept.

In case of the occurrence of delirium and muscular twitchings or convulsions, a few doses of sodium bromide should be given, in quick succession, until these manifestations of irritation of the nervous centres are quieted.

Alcoholic and other stimulants will be needed in this as in other acute diseases, when symptoms of exhaustion and threatened cardiac failure make their appearance. Of alcoholic stimulants, whisky, brandy, and champagne are the best. A tablespoonful of champagne, with one of iced water, every hour will be most grateful when there is much thirst and a dry, parched mouth; but in cases bordering on collapse, brandy or whisky in 1- or 2-teaspoonful doses, given in hot milk, is better. Hypodermic doses of strychnine, ether, or camphor dissolved in rectified spirits or almond oil (1 in 5) may be given at short intervals. In cases where food is taken badly by the mouth on account of difficulty in swallowing, fluid food, concentrated and highly nutritious, with the addition of some brandy, is indicated. An orthoform lozenge (gr. ¼) should be allowed to dissolve slowly in the mouth now and again: hot fomentations may be applied externally, and in the last resort rectal feeding must be adopted for a time.

The period of convalescence, in uncomplicated cases, will require careful watching and protection from chill. Light, nourishing food, and tonics, of which quinine and iron are the best, will also be needed. Jaccoud thinks that the restriction of the food to milk is a preventive of nephritis.

The treatment necessitated by the occurrence of certain **complications** and **sequelæ** must be very briefly noticed.

There can be little doubt that the glandular, visceral, arthritic, and other complications of this disease are caused by absorption of the infective virus from the throat and pharynx and adjacent parts, and that the early and thorough application of local antiseptic measures offers the most trustworthy means of protecting the constitution from the consequences of this secondary infection. It is desirable, therefore, from the first appearance of symptoms of this disease, frequently to irrigate or spray the throat and nasal passages with suitable antiseptic fluids, as already described (p. 640). If severe suppurative lesions occur in the throat, the fauces should be swabbed frequently with a 1:1,000 solution of perchloride of mercury, and the question of using antistreptococcic serum should be at least considered.

The evils resulting from the occurrence of **otitis media**, as a complication or sequel of scarlet fever, may sometimes be prevented by careful treatment at the onset of the symptoms. As soon as pain in the ear is complained of, a few drops of a mixture of equal parts of laudanum and glycerine, or of a 5 per cent. solution of cocaine and glycerine, may be dropped in, and a hot bran poultice at the same time applied. But the most effectual means of relieving the pain, which we have found succeed when other measures have failed, is to heat a large wine-glass by pouring hot water into it, and then to pour 10 to 20 minims of chloroform upon a small piece of cotton-wool in the bottom of the glass and hold the glass, closely applied, over the affected ear. The vapour of the chloroform enters the ear and acts both as an antiseptic and as an anæsthetic. Subsequently the chloroform may be mixed with tincture of iodine, and mixed chloroform and iodine vapours are thus conveyed into the ear, while iodine paint should at the same time be applied behind and in front of the ear. Some think highly of the early application of a leech to the posterior surface of the tragus. But we prefer the method we have just described to every other. Puncture of the tympanum has been warmly advocated if the pain and inflammation continue, and if, on examination of the ear by the speculum—a difficult matter in a very young child—the tympanum is found to be tense and bulging. This operation may save the membrane from ulceration and the patient from chronic suppurative otitis. After the puncture the antiseptic vapours of chloroform and iodine should be allowed to pass into the ear every few hours, as detailed above, and the throat should be kept diligently cleansed by antiseptic washes. It may be necessary in some cases, by means of Politzer's bag, to clear out pent-up secretion from the tympanic cavity. Should, however, ulceration of the tympanum have occurred and a putrid otorrhœa have been established, the ear must be gently syringed with a warm antiseptic lotion every four hours (a saturated solution of boric acid in water is as good as any), and afterwards a little fine powder of boric acid insufflated; or the iodine vapour and paint should be applied as already indicated. The external meatus may be lightly filled with a small plug of cyanide gauze, or iodised or menthol cotton-wool, or cotton-wool that has been dipped in a solution of zinc sulphate and rose water (5 grains to the ounce). At the same time careful watch must be kept for the first threatening of a mastoid abscess.

The **glandular** enlargements in the neck, which often follow scarlet fever, may frequently be dispersed quickly by steady and continued inunction of iodide of lead ointment; ichthyol ointment has been found useful for the same purpose. At the same time we should give cod-liver oil and syrup of the iodide of iron internally.

Pains in the joints of rheumatic character are not infrequent. They are seldom severe, and as a rule require no more than wrapping of the joints in cotton-wool, or hot anodyne applications. They often yield quickly to salicylate given by the mouth or applied locally. In the rare event of suppuration, incision and drainage, with full antiseptic precautions, are called for.

Albuminuria from nephritis (we do not refer to merely febrile albuminuria) occurs with very varying frequency in different epidemics of this disease. It is one of the most serious of the sequelæ of scarlet fever. It would seem consistent with observed facts to refer the nephritis to the irritation of the kidneys by the specific virus of the disease, but some of the cases are certainly determined by incautious exposure to chill during convalescence, and this will account for the number of cases that occur after quite mild attacks of scarlet fever.

The measures that should be taken to prevent the absorption of the infective agent, from the throat and adjacent mucous surfaces, have been fully dwelt upon, and here we must call attention chiefly to the importance of protecting the patient, during the period of convalescence and desquamation, from the possibility of chill. The child should be kept in a warm apartment during the three or four weeks that peeling is going on, and the urine should be frequently examined in order to detect the earliest sign of approaching nephritis. Should nephritis supervene, it must be dealt with according to the principles we have already laid down in treating of that disease.

MEASLES

Measles, like scarlet fever, is a highly contagious disease, and probably depends on the invasion of the body by a specific microbe; but this has not yet been discovered and cultivated. The contagion of measles, although not nearly so tenacious as that of scarlet fever, is far more diffusible; so that when it appears in a family its spread is more general. It is also infective from a very early stage, before any characteristic symptoms are manifested, and therefore before the nature of the illness is understood; hence it may be conveyed before the need of isolation has been recognised, and hence, no doubt, it is that school attendance is a most serious factor in the spread of the disease. The contagion appears to be in the breath, in the secretions from the disordered mucous membranes, and in the eruption on the skin, especially during the early stage of desquamation. It is regarded as infective for a fortnight after the appearance of the rash and as long as any desquamation or catarrhal symptoms exist. The contagion is said to be rapidly dissipated by ventilation, but we have known it remain in a room in a college, and affect two sets of adult residents, after an interval of six months. This disease attacks adults exposed to the infection, as well as children, and of all the specific eruptive fevers it is the one most prone to recurrence, and the least protective against subsequent attacks. It is very apt to follow whooping-cough, or to be followed by it. Indeed, any pre-existing catarrhal condition of the air-passages favours an attack. No disturbance of health is noticeable during the incubation period, which varies within very narrow limits—viz. from ten to thirteen days. The necessary period of quarantine, after exposure to infection, and after disinfection, is estimated at sixteen days, but we consider a few days more desirable.

Little **treatment**, beyond warmth and protection from unfavourable influences, is needed in ordinary cases of measles; but the tendency to complications and to sequelæ of a serious nature, especially affecting the respiratory organs, renders it necessary to observe great care and caution in the management of cases of this disease.

The malady commences with a somewhat sudden rise of temperature, which may reach nearly 104° on the first day. It then falls again a degree or two, until the appearance of the eruption on the fourth day, when it again rises. Characteristic **catarrhal** symptoms appear at the onset. There is often intense **coryza**, profuse running from the nose and eyes, the conjunctival and nasal mucous membrane being injected and swollen, and the eyes and face puffed. Laryngeal and bronchial catarrh may also be present, as indicated by a harsh, dry, distressing cough, and rhonchal and sibilant râles over the lungs. There may, at the same time, be some redness and soreness of the throat. The recognition of Koplik's spots on the buccal mucous membrane at this stage is an important aid in establishing the nature of the prodromal coryza. The eruption is usually of short duration, and desquamation, in the form of a fine, branny powder, begins on the sixth or seventh day of the fever, and lasts for a week or ten days. The patient remains highly infectious during convalescence, and to a very slight degree until desquamation is complete.

In well-protected and well-nursed children, measles usually runs a mild and favourable course; but occasionally cases occur of great gravity to which the term **malignant** measles is applied. The so-called **hæmorrhagic** form is now rarely seen. In this variety the rash is purpuric in character, and hæmorrhage occurs from all the mucous membranes: this form is rapidly fatal. A "typhoid" form has also been described; in this the fever is high and continued, the eruption is ill-developed, and of livid aspect, the pulse is quick and feeble, the tongue dry and brown, and drowsiness and delirium usually foretell a fatal end.

The most frequent as well as the most serious **complication**, and the one which is responsible for the deaths of most of the victims of this disease, is **broncho-pneumonia.** This is often attended in young children with extensive pulmonary collapse. There is a good deal of evidence to show that this broncho-pneumonia is itself communicable, so that isolation is imperative if other children occupy the same sick-room. Other complications which occasionally appear are severe intestinal catarrh (diarrhœa), acute laryngitis, epistaxis, troublesome ophthalmia, aural catarrh and deafness, and sometimes suppurative otitis. Of the more serious **sequelæ** we may mention catarrhal stomatitis and sometimes gangrene of the mouth (cancrum oris) or vulva, necrosis of the lower jaw, cervical glandular abscesses, and either *tuberculosis* of the bronchial glands, or tuberculous broncho-pneumonia, or miliary tuberculosis. So that measles appears as a very serious malady when regarded from the point of view of its complications and sequelæ. The more formidable of these are doubtless due to secondary invasion by septic and pyogenic micro-organisms.

With regard to the **treatment** of measles: * as we have already said, the mild and favourable forms, occurring in children of good constitution and sound health, require little besides isolation and confinement to bed in a *warm* airy room of a temperature of 65° to 70° F. and protection from all possibility of chill from currents of cold air. The bed may advantageously be screened from direct light if the coryza and photophobia are severe, and the eyes should be frequently bathed with a warm lotion of boric acid, 10 grains to each ounce of water. We should give the patient light and fluid food. Warm drinks, and warmth to the surface, certainly favour the complete and early development of the rash; and we believe, by promoting the early and full development of the eruption on the skin, we help to protect the child from respiratory complications. Although, in many cases, not absolutely necessary, we think it always desirable to order a diaphoretic mixture. In the first place it promotes the early and complete development of the rash and it impresses the patient's family with the need of careful nursing and protection from unfavourable influences. It is an error to treat lightly any case of measles, however mild the attack may at its onset appear to be. The following is a simple and useful medicine for the purpose we have named :—

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* The measures necessary for isolation and prophylaxis we have already fully dwelt upon in the two preceding sections, but owing to the very early infectivity of cases of measles they often fail in their object.

℞	Potassii nitratis	ʒj.
	Liquoris ammonii acetatis	℥ij.
	Vini ipecacuanhæ	♏xxxvj.
	Syrupi limonis	ʒvj.
	Aquæ	ad ℥vj.

Misce, fiat mistura. One to three teaspoonfuls, according to age, every four or five hours.

The bowels should be regulated, and a gentle aperient, such as a dose of citrate of magnesia, given if necessary. The child may be allowed to drink freely of barley water or lemonade. Care should be taken to keep the mouth clean by frequent irrigation with warm water, or in the severe cases with the chlorine mixture described in the formulæ at the end of this chapter. This is the surest way of guarding against the dangerous septic complications and sequels that now and again arise. Itching of the skin may be relieved by a daily warm bath and the use of carbolic soap, followed by inunction with one of the oily applications used in scarlet fever.

In the milder forms nothing more will be needed. As the eruption fades, a quinine tonic may be given twice a day, and a gradual return to the ordinary diet may be permitted. The child should be kept in bed for one week after the temperature has fallen to normal. In a case of ordinary severity he may quit the sick-room in three weeks from the appearance of the rash ; and provided he be thoroughly disinfected there is no need to await the completion of desquamation. The convalescence must, however, be carefully watched, the tendency to the development of tuberculosis borne in mind, and every possible risk of catching cold guarded against. The nutrition of the child must be carefully looked to; cod-liver oil may be given with advantage, with malt or syrup of hypophosphite of iron. In winter, or in inclement seasons, confinement to the house, for a month after the eruption has disappeared, is desirable. In fine weather a change to the seaside often proves useful, of course *after* all risk of diffusion of the disease has disappeared.

But in more severe cases other measures may be necessary. Cough may be troublesome simply from pharyngeal or laryngeal catarrh, and some sedative and expectorant may be required to relieve it. The following syrup will be found of use. When the cough is very dry and hard, a tablespoonful of hot water should be added to each dose:—

℞ Sodii bicarbonatis	gr. xxxij.
Ammonii chloridi	gr. xvj.
Vini ipecacuanhæ	♏xxiv.
Spiritus chloroformi	♏xlviij.
Syrupi tolutani	ʒvj.
Aquæ	ad ℥ij.

Misce, fiat mistura. One or two teaspoonfuls occasionally for the cough.

If the laryngeal irritation is severe and the cough troublesome at night, preventing the child from sleeping, a grain or two of Dover's powder may be mixed with a dose of the above and given at bed-time. A steam tent is also useful, with a dram of compound tincture of benzoin to each pint of water in the steam-kettle; and so are hot fomentations to the larynx frequently renewed.

If bronchial catarrh supervenes, the chest should be enveloped in a light cotton-wool jacket and some counter-irritant applied. One of the best is equal parts of turpentine liniment (B.P.) and olive oil, rubbed in freely and frequently over the front and back of the chest by the warm hand of the nurse covered with a flannel glove. A steam tent is needed, and we have found the inhalation of a warm spray consisting of

1 dram of glycerine of carbolic acid and 10 grains of sodium bicarbonate to an ounce of hot water most useful in the treatment of these infective ailments affecting the respiratory passages.

Mentholated vaseline may be applied to the nostrils with a camel-hair brush, for the coryza, when severe.

To promote expectoration, hot milk mixed with Apollinaris water, an ounce or two at a time, with half a teaspoonful to a teaspoonful of brandy, should be given every hour or two. An ammonia and senega mixture should also be prescribed:—

℞ Ammonii carbonatis	gr. xxxij.
Ammonii chloridi	gr. xxiv.
Tincturæ senegæ	♏lxxx.
Aquæ chloroformi	ad ℥iv.

Misce, fiat mistura. One to four teaspoonfuls, according to age, every two or three hours, in a little milk and water.

Dry-cupping has been recommended to relieve attacks of severe dyspnœa. If the temperature keeps high, with a burning, dry skin, sponging the body with tepid or cold water may be useful, and grain doses of quinine every three or four hours, dissolved in lemon juice and water, will be the best antipyretic. Severe prostration calls for the free exhibition of alcoholic stimulants.

Constipation is best relieved by small enemata of warm water containing a teaspoonful or two of glycerine; or of warm soap and water with a little olive oil or castor oil. Purgatives by the mouth should be used with caution owing to the tendency to severe diarrhœa. If diarrhœa occurs, it must be promptly treated by a bismuth and chalk mixture, with a few grains of compound kino powder in each dose, or by a few grains of tannate of bismuth in suspension with a grain or two of Dover's powder.

Vomiting is sometimes very troublesome, and may necessitate complete withdrawal of all food for a brief period.

The occurrence of convulsions, or of restlessness and delirium, must be met by the administration of sodium bromide, or, if this fail, by chloral enemata. Should the convulsions be associated with a recession, or an imperfect development, of the eruption, the child should be put into a hot bath, the head being at the same time bathed with iced water.

Otitis and **otorrhœa** should be treated as in scarlet fever.

Epistaxis, when continued and profuse, may require the insufflation of astringents such as powdered alum or tannin; or even plugging the nares may be necessary. The sequelæ of measles, such as cancrum oris, must be treated on the same general principles as apply to them when they occur in other circumstances.

RÖTHELN, RUBELLA, GERMAN MEASLES

This is a contagious eruptive fever, which usually runs a very mild course, and is attended by a measles-like eruption and enlargement of the lymphatic glands in the posterior cervical and mastoid regions.

Some slight catarrh of the eyes, nose, and throat, occasionally present, gives it a decided likeness to measles. The rose-pink macular eruption often seen on the soft palate must not be mistaken for the bluish Koplik's spots with their pink areola.

The affection occurs often in widespread epidemics, frequently attacking adults, and previous attacks of measles or scarlet fever afford no protection against it. On the contrary, recent convalescence from these and other acute diseases seems to favour its attacks. It was at one time regarded as a hybrid between measles and scarlet fever, but now it is universally recognised as a specific infection.

Its incubation stage is, on an average, about ten days, but it has been variously estimated at from seven to twenty-two days. It is distinguished from measles by the slightness or absence of the catarrhal symptoms, the mildness of the onset, the absence or slight amount of pyrexia, the tenderness of the posterior cervical glands, and the brighter colour and less diffused character of the rash.

A severe form of rötheln occasionally occurs, and then the cases bear a great resemblance to those of severe measles.

The *treatment* consists in brief isolation—a week or ten days from the disappearance of the eruption—which may be hastened by warm baths and frictions; mild salines and gentle aperients if necessary; light food, and in the more severe cases the same kind of management as that indicated in measles.

ERYSIPELAS

Erysipelas is an acute febrile infective inflammation of the skin, which also affects the mucous membranes that are continuous with the skin. It is attended by redness and swelling of the area affected, and is prone to spread rapidly over the surface, but it is always limited by a sharply defined margin. It is caused by the entrance into the skin or mucous membrane, through some abrasion or injury, of a well-known micro-organism, identical with the *streptococcus pyogenes*, but termed *streptococcus erysipelatosus* when associated with this disease. This organism is found in the lymphatic vessels and spaces at the spreading margin of the affected surface;* it is also known to be the cause of many other forms of septic disease, and if, in cases of this disease, it reaches the subcutaneous tissues *cellulitis* is produced, while if it gets into the blood it gives rise to a general septicaemia. Erysipelas was a common epidemic in the surgical wards of hospitals before the advent of "antiseptic" surgery. It usually arose in connection with defective hygiene, and, having attacked one case, rapidly spread to others. It often appeared to cling to particular beds or wards or parts of wards. Its relation to *puerperal fever* has long been known, and bacteriological investigations have shown that the same pathogenic organism is the active agent in both this disease and erysipelas.

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* According to Metchnikoff and others it is in the uninvolved tissue beyond this margin that an active struggle takes place between the micrococci and the leucocytes (phagocytosis) with the aid of opsonins in the blood serum.

It seems certain either that varying degrees of virulence are manifested by the same streptococcus, or that varying degrees of infectibility exist in persons attacked, and this must be taken as accounting for the different results produced by infection with it.

It seems to be capable of multiplying outside the human body, and its virulence may possibly be increased by temporary and local external conditions.

The tendency observed in certain patients to relapses and recurrences of this disease points clearly to the existence of an individual predisposition to the malady. It has been suggested * that persons with chronic coryza and a tendency for fissures to form about the nostrils and lips, affording a point of entrance to the micro-organism, are particularly prone to be thus affected. The predisposition seems to be sometimes inherited.

The frequent occurrence of relapses after an interval of many months has given rise to the hypothesis of "retained slumbering germs." Among predisposing agents we must include chronic alcoholism, chronic Bright's disease, a low, depressed state of health, and bad hygienic surroundings. The period of incubation may be very brief, not more than seven to ten hours; in other cases it may be six to eight days or longer. The subsequent severity of the case seems to be quite independent of the length of the incubation period, and wholly dependent on the degree of virulence of the streptococcus and the individual predisposition.

The mode of onset of the disease varies; sometimes the local manifestation seems to precede the constitutional symptoms; but frequently the disease commences somewhat suddenly with a severe rigor and a simultaneous appearance of the eruption.

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* Nothnagel's "Encyclopædia of Practical Medicine," English translation, art. "Erysipelas."

The face is the part most commonly attacked, and the immediate neighbourhood of the eyes the situation first affected.

The eruption spreads rapidly, and is attended in the part affected with a feeling of pain and tension. The skin is hot, red, tender, tense and shining, and the inflamed part is sharply defined and separated from the adjacent healthy skin by an elevated margin. The course of the eruption is often checked where the skin is dense and firmly attached to subjacent tissues; and where the skin is loosely connected with subjacent parts inflammatory œdema is marked, as in the eyelids, prepuce, labia, and scrotum. After two or three days the redness and swelling disappear in the part first attacked, and extend into adjacent parts. In severe attacks vesicles and bullæ appear on the inflamed surface. The face is often greatly swollen, the eyes are closed by the swelling, the lips œdematous, and the features distorted and unrecognisable.

There is usually some lymphadenitis affecting neighbouring glands and occurring early in the attack. The daily advance and spread of the sharply defined raised margin, while the area first attacked becomes pale, smaller in extent, and undergoes desquamation, is very characteristic of this disease. Great variability may, however, be noted in the rapidity of the advance as well as in the extent of surface covered. Its *duration* depends on its extent. When the face and scalp alone are involved it rarely lasts longer than eight or nine days; but if it wanders extensively over the body it is apt to recur in places originally or earlier attacked, and thus it may last several weeks.

Accompanying the initial rigor there are usually vomiting and a rise of temperature to 104–105° F. As a rule the rise of temperature bears a close relation to the severity of the dermatitis, disappears with it, and returns with its recurrence. Some authorities maintain that certain cases of erysipelas run an *afebrile* course, but this is doubted by others.

When erysipelas attacks first the mucous membrane of the throat its true character cannot be determined until the eruption appears in the skin. We must bear in mind that pharyngeal erysipelas may extend to the larynx, and thus give rise to very serious obstruction to respiration.

Erysipelas of the head and face is almost always accompanied by headache, and not rarely by restlessness and slight delirium. Various septic complications may arise from the escape of the streptococci into adjacent parts ; thus we may have cellulitis, meningitis, pneumonia, endocarditis, pericarditis, peritonitis, etc. etc., all of septic origin. The affected glands may suppurate, and purulent œdema may develop. Acute nephritis is rare, but febrile albuminuria is common.

A tendency to recurrence is more common in this than in any other acute infective disease. The protection afforded by one attack is slight and of short duration.

The foregoing brief sketch of the chief clinical features and course of this disease will serve as a fitting introduction to a consideration of its **treatment.**

With regard to *prophylaxis*, it is almost superfluous, nowadays, to insist on the urgent need for rigid isolation of erysipelas from surgical wards. This is universally understood and carried out. It seems to us almost equally important to isolate this disease also from medical cases, as breaches of surface, bed-sores, etc., are of common occurrence in medical wards, and the fact that it may attack the throat should not be overlooked. Some hospital authorities think it advisable to *isolate* all cases of severe *sore* throat for a few days, lest erysipelas or latent scarlet fever should be accidentally introduced into the general wards. We have already called attention to the suggestion that the subjects of " habitual erysipelas" frequently suffer from chronic nasal catarrh with itching of the nose, and in their attempts to relieve this they cause abrasions of the surface through which the infective cocci may gain entrance. It is said that treatment of the nasal condition has been found permanently to prevent the return of erysipelas. Lenhartz, of Hamburg, who makes this statement, claims to have cured the tendency by ordering cold cream to be rubbed into the nostrils night and morning, not only anointing the alæ but sniffing it well up the nostrils.* If any other focus of infection can be found it must receive appropriate treatment.

Various measures have been suggested and applied *locally* to relieve the pain and tension, to arrest the extension of the advancing dermatitis, and to destroy the infective agent *in situ*. A few of these may be mentioned, but a great number have been discarded, after prolonged trials, as they have not been found to fulfil the expectations of those who introduced them. We shall only consider such measures as are suitable for cutaneous erysipelas, since with the first warning of invasion of the deeper tissues the condition passes into the region of active surgical interference. The attempt to limit the extension of the inflammation by *mechanical* means, such as *strips* of *adhesive plaster*, elastic bands, and broad circular strips of *collodion*, has now been abandoned in favour of other methods. These measures aimed at mechanically preventing the spread of the germs into adjacent tissues.

Other practitioners have thought that they could prevent the growth of the organism by keeping the air from the affected surface. Unna's jelly is an admirable preparation for the purpose; it is warmed to melting and then painted over the area, forming a smooth supple coating. It may be impregnated with antiseptics at will, and will carry as much as 20 per cent. of ichthyol. Rubber protective has been used for this purpose, applied smoothly and firmly over the whole erysipelatous area and a hand's breadth of healthy skin beyond. Painting the same extent of surface repeatedly with collodion or a combination of collodion and ichthyol has been extensively employed. The latter has been used of a strength varying from 10 to 50 per cent., and painted on in a tolerably thick layer. The stiff film of collodion, even when made more flexible by the addition of castor-oil, is however an annoyance to many patients. The use of ichthyol is regarded by many as acting beneficially by a special effect on the streptococci, and they use an ichthyol ointment made by mixing it with vaseline in the proportion of 25 to 50 per cent. This ointment is rubbed in daily over and somewhat beyond the affected surface. Another satisfactory method is to apply with a loose paint-brush a 25 per cent. aqueous solution of ichthyol; a fresh coat is added every two hours, so that at the end of twenty-four hours the whole surface is covered with a thick deposit of ichthyol.

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* Nothnagel's "Encyclopædia of Practical Medicine," English translation, art. "Erysipelas."

This ichthyol treatment is in our opinion the treatment par excellence for erysipelas. Objection is often taken to the odour and colour of ichthyol. As a fact the odour disappears quickly on exposure, and may, if wished, be readily hidden by the addition of a small quantity of oil of citronella or a trace of vanillin. The colour is only of moment in the case of the face, when a mask of lint may be worn. Recently *thigenol* has been suggested as a substitute for ichthyol on account of its freedom from these drawbacks, but it does not appear to be so efficacious as ichthyol. In the absence of ichthyol carbolised vaseline is a satisfactory preparation to employ.

Some simply dust the surface over with a mixture of zinc oxide and salicylated starch and cover with cotton-wool; or subnitrate, or, better, subgallate of bismuth ("dermatol") is used, or a powder made by shaking up ½ an ounce each of zinc oxide and lycopodium powder thoroughly with 15 to 30 minims of liquefied carbolic acid.

Another favourite application is a powder composed of equal parts of boric acid, starch, and zinc oxide; this is kept on by lint and a bandage, and if the face is affected a mask is applied. Pain may be relieved by a lead and opium lotion.

The application of various irritating antiseptic agents at and a little beyond the margin of the spreading area has been much practised, with the object of exciting a protective leucocytosis ahead of the bacterial advance. Tincture of iodine has been so used, so has painting with a stick of lunar caustic; various applications containing corrosive sublimate, carbolic acid, resorcin, etc. etc. (including the subcutaneous injection of a 2 per cent. solution of carbolic acid by a series of pricks around the area), have been tried. Dr. Lobit, of Biarritz, maintains that he has been able to abort many attacks by the application, first at the spreading margin, and then over the whole surface affected, of a collodion containing 10 per cent. of iodol. A thick layer is applied with a brush, care being taken to pass one or two centimetres beyond the inflamed margin. Some have gone to the extent of making incisions into the skin before applying antiseptic agents, but it cannot be said that any of these methods have been so uniformly successful as to merit general adoption, and the simpler measures amongst those we have enumerated are perhaps still the most commonly practised.

Bathing the head with iced water will often relieve the severe headache; and tepid baths, with cold irrigations, may be needed when there is much fever with restlessness and insomnia.

Early tracheotomy may be required in laryngeal erysipelas.

Of internal remedies, the tincture of the perchloride of iron given frequently (every three or four hours) in full doses (20 to 30 minims) has been found of much value in this country; quinine also, in 3- to 5-grain doses, has been found beneficial, and the two may be advantageously combined.

Sodium salicylate internally and externally has been highly extolled as a remedy for erysipelas by Hallopeau, J. W. Moore, and others. Compresses soaked in a 1 in 20 solution of sodium salicylate are applied to the inflamed surface, and covered with oil-silk, and frequently renewed. Internally about 60 grains of the salicylate are given daily, or this salt is given on alternate days and quinine on the intermediate ones. If cerebral symptoms or dyspnœa become prominent, this treatment is suspended. We must confess to disappointment in the use of this remedy.

A few doses of phenacetin may be given when the temperature is high and the patient becoming restless; or it may be needful to relieve insomnia and delirium with a mixture of chloral and bromides, or, in some cases, opium may be required.

In threatened heart failure, digitalis may be necessary, or strychnine, or ether hypodermically. Lenhartz speaks highly of Merck's *digitoxin*, $\frac{1}{250}$ to $\frac{1}{100}$ grain three or four times daily, but after 6 or 8 doses its administration must be suspended for 24 hours; it should never, he says, be given for more than a week. Nativelles *granules de digitaline cristallisée*, $\frac{1}{4}$ milligramme in each, are another convenient form for administration.

Old and feeble people will require to be supported by alcoholic stimulants; but these should not be given in a routine fashion, as is too common. They should never be given apart from food, lest the patient come to depend on them and neglect the food, which is of prime importance in such an exhausting disease as erysipelas. The diet should be light and nourishing, and consist of milk, beaten-up eggs, clear soups, and broths. For the thirst, cold tea, iced home-made lemonade, or water flavoured with fruit juice can be prescribed *ad libitum*. The bowels should be kept regulated from the onset by gentle aperients if needed.

A brief reference must now be made to the **serum**

treatment of erysipelas. In a self-limited disease like erysipelas, and one presenting, at different times, such varying degrees of virulence, it is needful to be very cautious in the conclusions we arrive at as to the effect of any remedy. This remark seems particularly applicable to the conclusions which were arrived at by those who first applied the anti-streptococcus serum to the treatment of this disease.

Marmorek's serum was obtained by inoculating animals (the horse especially) with regularly increasing quantities of highly virulent streptococcus cultures. Serum of high potency was thus obtained, but the results yielded by it were very disappointing. Failure was ascribed to difference in character of the streptococci used for immunising the horses from those present in the diseased states for which the antiserum was employed. With a view to correcting this, horses were inoculated with streptococci from many sources, so as to obtain a "polyvalent" serum.

Though as a whole the results even with polyvalent serum have been disappointing, it cannot be denied that now and again excellent results have been obtained. We would, however, not recommend its routine employment, but would keep it in reserve as a possible auxiliary in the fight with a severe attack. In the case of erysipelas the injections should be made around the affected area. The sera of different makers are not of equal strength, so that each has its own appropriate dose. The dose of the polyvalent antistreptococcic serum supplied by the Lister Institute is 30 c.c. for the initial injection, and this may be repeated daily, or in smaller doses at shorter intervals, until signs of improvement are seen. If more constantly good results are to be secured, it must be by the preparation of a polyvalent serum capable of combating "every" strain of streptococcus. At present, if one serum fails, the only course is to try another, and there are great objections to repeated injections of an antiserum, of which horse's serum is the basis, in the not infrequent occurrence of many disagreeable after-effects. Among these are rigors and fever, an intensely irritable exanthem, severe pain in the muscles, and painful swelling of the joints.

We cannot close our account of the treatment of erysipelas without alluding to the remarkable effect which an attack of this disease sometimes exerts on certain sarcomatous tumours and certain chronic skin affections. Complete disappearance of sarcomatous growths has been observed, and patients have been inoculated with erysipelas as a curative agent; but this treatment has been abandoned on account of the severity of the symptoms thus induced. Now, however, the *toxines* obtained by cultivating the *streptococcus erysipelatosus* and the *bacillus prodigiosus* together in *bouillon* (Coley's fluid) have been used for the same purpose, and in some instances with success.

ADDITIONAL FORMULÆ

SMALL-POX

Febrifuge mixture in initial stage of small-pox

℞ Spiritus ætheris nitrosi, ℥ss.
Syrupi limonis, ℥ss.
Liquoris ammonii acetatis ad ℥vj.

M. f. mist. Two or three teaspoonfuls every two hours in a little ice-water. (*Welch.*)

Carbolic acid mixture in small-pox

℞ Acidi carbolici, ♏xv.
Tincturæ cinchonæ, ʒij.
Syrupi aurantii, ʒiv.
Mucilaginis acaciæ, ℥j.
Aquæ ad ℥v.

M. f. mist. A tablespoonful every two hours. (*Audhoui.*)

In hæmorrhagic small-pox

℞ Extracti ergotæ liquidi, ʒiij.
Olei terebinthinæ, ʒiij.
Spiritus ætheris nitrosi, ʒij.
Spiritus rectificati, ℥j.
Ovi vitelli, ℥j.
Aquæ menthæ piperitæ ad ℥viij.

M. f. mist. An eighth part every third, fourth, or sixth hour, as required.
(*J. W. Moore.*)

Local application for the eruption

℞ Linimenti calcis ad ℥viij.
Olei eucalypti, ℥ss.
Calaminæ præparatæ, ʒj.

M. f. applicatio. To be applied with a large camel-hair brush to the skin of the face every two or three hours.
(*Whitla.*)

Ointment for the eruption

℞ Acidi salicylici, ʒj.
Pulveris amyli, ʒx.
Glycerini, ℥iv.

M. f. ung. To be applied on lint to the face. (*Lewentaner.*)

Ointment and powder (disinfecting) for small-pox

℞ Sodii salicylatis, ʒj.
Vaselini, ℥iij.

M. f. ung. Apply to the parts affected, and afterwards dust them with a powder composed of 2 drams of sodium salicylate and 3 oz. of talc. (*Baudon.*)

Iodine application for the pustular stage of small-pox

℞ Tincturæ iodi, ʒss.
Glycerini ad ℥ij.

M. f. app. To be applied to the skin with a brush every four hours. (*Pioch.*)

SCARLET FEVER AND ERYSIPELAS

Chlorine mixture for scarlet fever

℞ Pulveris potassii chloratis, gr. viij.
(Pour on this in a pint bottle):
Acidi hydrochlorici puri, ʒj.
(Cork the bottle and shake occasionally.)
Aquæ ad Oj.

After a time, add the water little by little, shaking at each addition (in cold weather the bottle should be first warmed).

A tablespoonful, or two, of this mixture, according to age, may be given frequently. An adult may take the whole pint in a day. (*Watson.*)

"Diaphoretic, diuretic, and laxative" mixture for scarlatinal nephritis

℞ Potassii acetatis
Potassii bicarbonatis } āā ʒij.
Potassii citratis
Infusi tritici repentis ad ℥viij.

A teaspoonful every three or four hours for a child of five years. (*J. Lewis Smith.*)

Quinine mixture in mild cases of scarlet fever

℞ Quininæ sulphatis, gr. xvj.
Syrupi pruni virginiani, ℥j.
Syrupi yerbæ santæ, ℥j.

M. f. syrup. One teaspoonful every three or four hours for a child from three to five years old. (*Prof. J. Lewis Smith.*)

Diaphoretic mixture in early stage of scarlet fever

℞ Spiritus ætheris nitrosi, ʒij.
Potassii citratis, ʒj.
Liquoris ammonii acetatis, ℥jss.
Syrupi simplicis, ℥j.
Aquæ camphoræ ad ℥iv.

M. f. mist. A teaspoonful every three hours. (*Whitla.*)

Mixture for scarlatinal nephritis

℞ Potassii acetatis, gr. xx ad gr. lx.
Syrupi simplicis, ʒiij.
Infusi digitalis ad ℥iij.

M. f. mist. A teaspoonful every two hours. (*Widerhofer.*)

Tonic powders during convalescence from scarlet fever

℞ Ferri carbonatis saccharati, gr. viij.
Quininæ sulphatis, gr. viij.
Sacchari albi, gr. xl.

M. et divide in pulv. x. One night and morning. (*Widerhofer.*)

For scarlet fever with diphtheritic throat affection

℞ Potassii chloratis, gr. xx.
Syrupi aurantii, ʒiij.
Decocti cinchonæ ad ℥iij.
M. f. mist. A teaspoonful every two hours.

℞ Potassii chloratis, ʒj.
Aquæ, ℥xij.
M. f. gargar.
(The diphtheritic spots to be also touched with pure lactic acid.) (*Widerhofer.*)

Spray for the throat in scarlet fever

℞ Glycerini boracis, ʒiv.
Glycerini acidi carbolici, ʒiij.
Aquæ rosæ ad ℥x.
M. (*Whitla.*)

Antiseptic application for the fauces when foul and offensive in scarlet fever

℞ Acidi carbolici, ♏x.
Liquoris ferri subsulphatis, ʒiij.
$\left.\begin{array}{l}\text{Glycerini}\\ \text{Aquæ}\end{array}\right\}$ āā ℥j.
M. f. applic. To be applied with a large camel-hair pencil every three to six hours.
(*J. Lewis Smith.*)

Lotion for the itching of the skin in scarlet fever

℞ Acidi carbolici, ʒj.
Tincturæ camphoræ, ℥ij.
Aquæ puræ, Oj.
M. f. lotio. Shake well and apply over surface when needed for pruritus.
(*Prof. J. Lewis Smith.*)

Chloral enemata for eclamptic convulsions in scarlet fever

℞ Chloral hydratis, ʒss.
Decocti althææ, ℥vj.
M. A fourth part to be injected into the rectum the moment the convulsions commence. (*Widerhofer.*)

Ether and camphor injection (hypodermic) in case of collapse

℞ Camphoræ, ʒss.
Ætheris, ʒv.
M. Twenty minims to be injected under the skin.
(*Widerhofer.*)

Ointment for erysipelas

℞ Creolin, 1 part.
Iodoform, 4 parts.
Lanolin, 10 parts.
M. f. ung. (*Koch.*)

Spray for erysipelas

℞ $\left.\begin{array}{l}\text{Hydrargyri perchloridi}\\ \text{Acidi citrici}\end{array}\right\}$ āā gr. xv.
Alcohol absolute, ʒjss.
Ætheris sulph. ad ℥iij.
M. f. applic. The spray to be followed by boric acid lotion and 1 per cent. ethereal solutions of sublimate.
(*Cayet and Talamon.*)

Mixture in erysipelas

℞ Ammonii carbonatis, ʒjss.
Decocti cinchonæ, ℥vj.
M. f. mist. Two tablespoonfuls with a tablespoonful of fresh lemon-juice every four or six hours. (*Moore.*)

Another

℞ Tincturæ ferri perchloridi, ʒij.
Quininæ sulph., gr. xxiv.
Spiritus chloroformi, ʒij.
Aquæ ad ℥vj.
M. f. mist. Two tablespoonfuls every three or four hours.
(*J. B. Y.*)

Application to prevent the spread of erysipelas

℞ Argenti nitratis, gr. lxxx.
Acidi nitrici, ♏vj.
Aquæ destillatæ, ℥ss.
M. f. solutio. To be painted over the inflamed surface and for two or three inches beyond it two or three times a day.
(*Higginbottom.*)

CHAPTER IV

TREATMENT OF TYPHOID OR ENTERIC FEVER, AND OF TYPHUS FEVER

TYPHOID FEVER — Nature and Origin of the Disease — The Typhoid Bacillus — Diffusion — Characteristic Lesions — Symptoms and Course — Protective Inoculation — Antityphoid Serum — Prophylaxis and Disinfection — *Chronic Typhoid Carriers*—Indications for *Treatment*—General and Special—The Personal Care of the Patient—Diet—Stimulants—Antiseptic Treatment—Intestinal Antisepsis—Various Antiseptic Agents used—Chlorine and Quinine—Good Results of this Method — Calomel — Sulphurous Acid — Naphthol—Salicylate of Bismuth—Thymol—Carbolic Acid—Turpentine—Salol—Oil of Eucalyptus—Urotropine and Bacilluria—Hydrotherapy, etc.—Treatment of Complications — Hyperpyrexia — Cold Applications — Diarrhœa — Hæmorrhage — Perforation — Cardiac Asthenia and Pulmonary Congestion—Thrombosis — Nervous Symptoms — Bed Sores — Convalescence. TYPHUS FEVER.—Additional Formulæ.

TYPHOID FEVER

WE cannot here enter into a detailed examination of the history, pathology, and clinical course of **typhoid fever**; we shall only therefore call attention to those facts in connection with its origin, dissemination, symptoms, and course which are essential to a comprehension of its true character, and which may enable us to establish rational indications for its treatment. Moreover, the history, pathology, and morbid anatomy of this disease have been so well studied and so frequently described, and its clinical course and results are so well known, that we should only be going over ground familiar to most of our readers in dwelling at any length on these details.

With regard to the mode of origin and nature of this disease, it is generally known to be an infective bacillary disease, caused by the introduction into the human body of a specific pathogenic organism

—the so-called bacillus of Eberth, or the *bacillus typhosus.* It is "primarily a general infection with secondary intestinal lesions." The bacillus is flagellated, motile, 1 to 3 μ in length and ·5 to ·8 μ in diameter. It has rounded ends and sometimes occurs in chains. It does not form spores: the glistening round bodies seen at its ends, and thought formerly to be spores, are probably areas of degeneration. The toxine belongs to the intracellular group. The bacillus grows readily in bouillon and milk and on gelatin, agar, blood serum and potato. It is killed by a temperature of 60°, but is very resistant to cold and will live for three months in ice. These bacilli have been reported as living for eighty days in drinking water. They can live for some time in the soil, but there is no evidence that they can multiply in it. They can resist drying, and they have been known to live for nearly three months on soiled clothes.

The *bacillus typhosus* is one of a group of organisms which resemble one another in certain particulars. The best known of these are the colon, the paracolon, the paratyphoid bacillus and the *b. enteritidis.* They can be distinguished by certain cultural differences.

The *bacillus typhosus* fulfils the three conditions necessary to establish its causal relation with typhoid; it is constantly present in the characteristic lesions, and it grows outside the body in a specific manner. The third condition—viz. the experimental production of the disease by the introduction of pure cultures into the bodies of healthy animals—has only recently been realised, owing to the difficulty of producing typhoid in the animals hitherto experimented upon, but Grünbaum has succeeded in producing the disease in chimpanzees—four became infected, two died and the others were killed on the twelfth and thirteenth days, and the characteristic lesions were found.* As this bacillus retains its vitality for many weeks when mixed with sand or earth and dried, it may be blown about in dust, and this mode of spread of the disease was largely realised during the campaign in South Africa. *Uncooked* substances used as food, if exposed to dust or water infected with these bacilli, may be the means of conveying the disease. It is believed that flies play an active part in its dissemination. The bacilli have been found in the pallial cavity and in the intestine in oysters, mussels, and other bivalves living in water that has become contaminated by sewage.

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* McCrae on Typhoid Fever. Osler and McCrae's "System of Medicine," vol. ii., p. 90. London, 1907.

In man the typhoid bacilli are found in the lymphoid tissues of the intestine, in the mesenteric glands, and in the spleen and liver, also in the blood, the bile, the urine, and the fæces. They can be most frequently found in the blood in the early stages of this disease. They are found also in relapses. "It may be considered that in all cases the bacilli are in the circulating blood at some period, and that this can be shown in nearly all patients by proper methods" (Mc Crae). They are found in the *rose* spots.

In some cases the bacilli become very *widely diffused* through the organism, and have been found in the cerebral meninges and ventricles, in secondary abscesses and in every one of the viscera and glands.

The occurrence of the bacilli in the urine is of great importance in connection with the dissemination of the disease. They rarely appear in the urine until the third week, and sometimes not until convalescence. It is estimated that they can be found in the urine in about 25 per cent. of cases. "The number which may be present is enormous, and billions of bacilli may be excreted each day; if we consider the length of time during which typhoid bacilli may remain in the urine, it is no exaggeration to say that a man may scatter infection around the world" (McCrae).

This organism is clearly, then, the **infecting agent.** How does it become disseminated so as to communicate the disease from the infected to the non-infected? Although it is mainly given off in the stools and in the urine of typhoid patients, yet it is sometimes *directly* communicated from sick persons to the attendants, or others brought into contact with them. This probably arises through want of sufficient precaution in handling the patients, or the linen soiled by their evacuations. We have known the infection to cling to a particular bed in a general hospital and infect a succession of patients admitted with other diseases, until the bed was removed. It therefore appears certain that, if great care and cleanliness are not observed with regard to the bed and body-linen of the patient, the infection may be diffused from the dried excretions through the air immediately around him.

The *direct* conveyance of infection must always be due to some defect in details of cleanliness and caution. The most common mode of *indirect* communication is undoubtedly through the contamination of *water* by typhoid dejecta. The origin and spread of many epidemics have been clearly shown to be so produced. *Milk* is a common vehicle of dissemination (usually from the use of contaminated water for washing the milk cans), and in this fluid the germs are said to multiply rapidly. The *gases* escaping from infected sewers are not themselves infective, but in their escape, especially under pressure, they may mechanically convey the solid germs to where they become the source of mischief. Having entered the human body, which they almost invariably do by the mouth, and having reached the intestinal canal, these germs appear to pass through the epithelial lining to the subjacent lymphoid tissue, where they excite a specific irritation which leads to active cell proliferation. If this hyperplasia of the lymph-follicles reaches a certain degree from excessive action of the poison, necrosis occurs with the formation of an ulcer. At the same time the mesenteric glands, the spleen, and the liver are affected by the action of the bacilli, and become enlarged—particularly the spleen and the mesenteric glands. In a certain proportion of the cases an intestinal catarrh with diarrhœa (pea soup-like evacuations) accompanies the intestinal ulceration. Susceptibility of the individual plays a certain part in the incidence of this disease. Persons between the ages of 5 and 35 are most liable to be attacked. It is rare after middle age, but when it occurs then it runs a severe course. The immunity conferred by an attack is considerable, but not absolute. It is well to remember that the bacillus is "dependent on man for its existence, and although it may live for a time in water and in various articles, yet its life in such situations is comparatively short" (McCrae).

The **intestinal lesion** is the most characteristic and the most important one in typhoid fever. There may be only a few small superficial ulcers, or the ulceration may be extensive and involve large tracts of mucous membrane. There are cases in which *no* intestinal lesion has been found, but these are very rare. The ulcers are most common at the lower part of the ileum. The solitary glands of the cæcum and colon are also frequently affected, and may go on to ulceration. This intestinal ulceration is the cause of two of the most serious incidents of the disease—*i.e.* peritonitis from perforation of the floor of the ulcer, and hæmorrhage during separation of the sloughs. The spleen is always more or less enlarged, sometimes considerably so, and the liver generally, but not always. The mesenteric glands corresponding to the affected part of the intestine are also swollen. Bacilli are found in large numbers both in the spleen and the mesenteric glands. Degeneration of the myocardium, hypostatic congestion of the lungs, bronchitis, ulcers of the larynx, and morbid changes in many other organs may arise in the course of the severer forms of the disease.

The main **symptoms** of the fever are briefly these:—During the incubation period, which lasts on the average about ten to fourteen days, and ranges between two and twenty three days, there is complaint of lassitude and weariness; then the disease sets in with chills, headache, loss of appetite, nausea, pain in the limbs and back, frequently slight bronchitis, and occasionally epistaxis; the temperature usually rises steadily in a step-like manner, day by day, during the first week, until it reaches 103° to 104°, or higher; there is a quick pulse, 100 to 120, of low tension, and often markedly dicrotic; the tongue is coated with a yellowish-white fur, and the tip and edges are characteristically clean and red; there may be slight rambling at night; slight diarrhœa may already appear; but, on the contrary, the bowels are often constipated at this stage, and in many cases remain so; some enlargement of the spleen may be detected about the end of the first week (though not always to be made out); and at this period the characteristic *rose-spots* begin to appear, usually on the abdomen and the back and lower part of the chest, and as the *bacillus typhosus* has been isolated from these rose-spots, they appear to be specific in nature and the result of the presence of this organism; some cough from bronchial catarrh is not uncommon. During the second week the temperature remains high, and the morning remissions are slight, there is dulness of intellect, and the tongue becomes dry; if the case is severe and abdominal symptoms become pronounced, there are diarrhœa, tympanites, and tenderness, especially over the right iliac region. The urine has the usual febrile character: it is high-coloured, scanty, and of increased density; contains an excess of urea, uric acid, and of salts, except sodium chloride, which is diminished. In severe cases it often contains albumen. In the third week the temperature usually shows marked remissions in the morning, and the fever begins to decline, debility and emaciation are notable, and the diarrhœa and abdominal distension may continue. This is often the critical period in the illness, when unfavourable symptoms may appear, such as delirium, a dry, brown tongue, cardiac debility and pulmonary congestion, intestinal hæmorrhage or perforation.

Convalescence, in favourable cases, usually begins in the fourth week (in slight cases earlier): the temperature falls to normal, the diarrhœa (if there has been any) ceases, the tongue cleans, and the appetite is often ravenous; but in bad cases the serious symptoms we have previously mentioned may become intensified, and the patient may lie in a state of profound prostration. **Relapses** are prone to occur. The *ordinary* relapse sets in, on an average, about five days after complete defervescence; in some instances it has been known to be deferred for three weeks or longer. The symptoms are the same as those of the original attack, but its course is usually shorter and less severe. It is not uncommon to meet with what are termed "*intercurrent*" relapses; in such cases the relapse occurs in the course of the original attack, the temperature, after falling for a few days to 100° or 101°, again rises, and the patient passes through another attack, which may be even more severe and protracted than the first.

Great variations in the course and severity of cases of typhoid are observed in different epidemics, and we should be especially on our guard with respect to what has been termed the "*ambulatory form*," in which the initial symptoms have been so slight and indefinite that the patient keeps on with his usual occupation, and may only come under our notice in the middle or towards the end of the attack. Then very serious symptoms may set in, and a rapidly fatal issue is not uncommon; in other cases the febrile symptoms are, all through the attack, so slight that it is with difficulty the patient can be made to realise that his illness is of a serious nature.

This brief sketch of the chief characters of typhoid fever will be supplemented, and filled in, by the details which will naturally arise for consideration in discussing questions of *treatment*. But before passing on to that part of the subject, it will be necessary to refer briefly to the matter of **protective inoculation,** which has recently been practised on a large scale. Typhoid fever is one of the chief scourges of armies in the field, as well as a danger to which travellers are often exposed in many parts of the world. It would lead to a great saving of human life if a trustworthy protective fluid could be discovered which could be applied, without any undue risk, as a prophylactic to those who are especially liable to exposure to this infection of typhoid. We are indebted to Sir A. E. Wright for the preparation of a *vaccine* which has been very extensively used for this purpose, especially in India and in South Africa. It is thought probable that the doses of vaccine used at first were too large and produced severe reactions. Recently Wright has vaccinated with typhoid bacilli (from an avirulent culture) grown in agar and sterilised by heat. The operation is effected in two stages—the first dose consists of 1,000 millions of bacilli; this is followed ten days after by a second dose of 2,000 millions. The inoculation is usually made in the flank. The evidence as to the protective value of this method is somewhat inconclusive. But, although some weighty opinions, of an unfavourable import, have been published, the balance of evidence seems to be in favour of the belief that it produces a relative but not an absolute protection. In many reports of its influence during the South African campaign, the percentage of persons attacked appears to have been much greater amongst the uninoculated than the inoculated, and the mortality amongst those attacked much lower amongst the inoculated than the uninoculated. Bulloch maintains that "most impartial observers have come to the conclusion that antityphoid inoculation has substantially diminished the incidence and death-rate of enteric fever." We may as well refer in this connection to the use of *antityphoid serum* in the treatment of this disease. As the result of attempts in this direction made some years ago no unanimity was arrived at by different observers, and in this country at any rate the attempt has not been persevered in. But recently

Professor Chantemesse, in Paris, reported that he has been using a serum in the treatment of over 700 cases of typhoid with a mortality of 3·7 per cent. as compared with 20·9 per cent. in other hospitals. These results have not, however, been confirmed by others, and the general impression still entertained is that antityphoid sera are not of much value.

We now pass on to the question of general domestic and individual **prophylaxis.** It should be borne in mind that typhoid is conveyed in the great majority of cases by polluted drinking-water; and whereas we should, at all times, be on our guard against drinking any water of the purity of which we are not absolutely sure, during the prevalence of this disease, or when travelling from place to place, we should be more especially careful to drink no water that has not been **boiled.** A filter, if kept sterile, is a convenient vessel in a house for the storage of drinking-water, but the water supplied to the filter should be boiled—a duty which should only be confided to a thoroughly trustworthy person. In travelling, either a mineral table-water of known purity should be drunk, or some simple means for boiling water should be carried.

Milk is also a common medium for the conveyance of the typhoid germs, either owing to its dilution with impure water, or from the use of impure water for washing the milk cans; but milk, being very absorbent, may become contaminated by exposure to impure air. It is therefore a good rule in families that all milk should be boiled on being delivered, and subsequently stored in a closely-covered vessel.

The certainty that the germs of typhoid may be conveyed by the gases escaping under pressure from infected drains and sewers has led to the universal recognition of the necessity of thoroughly ventilating all soil-pipes, drains, and water-closets.

The fact that bacilli may live in the body long after recovery, showing that recovery from the disease does not necessarily mean the destruction of the bacilli in the body, has an important bearing on prophylaxis, and may afford an explanation of many outbreaks, hitherto of obscure origin. Connected with this fact has been the discovery of *chronic typhoid carriers*, more especially in association with some epidemics, otherwise of inexplicable origin, occurring in certain lunatic asylums and elsewhere. Some remarkable instances have been reported in Germany and America of the dissemination of typhoid fever through the agency of these *chronic typhoid carriers.* Quite recently A. and J. C. G. Ledingham have published a very interesting report of their observations on this subject made in connection with "the mysterious cropping-up" of typhoid cases in a certain lunatic asylum in Scotland.* They examined fifty-seven samples of fæces from female patients—one was found to be passing typhoid bacilli in enormous numbers in the fæces, although there was no record (she had been in the asylum since 1896) of her having had typhoid fever; but her personal habits were very filthy. Her serum agglutinated the *B. typhosus* up to 1 in 200. In this case the appearance of the bacilli in the fæces was *intermittent.* None were ever found in the urine. In another case in which typhoid bacilli were found in the urine the patient had had an attack of typhoid in 1895, and a third had an attack in 1904.

These observers succeeded, therefore, in isolating three typhoid carriers out of a total of ninety females examined. The serum in each case gave a marked Widal reaction. It seems probable, as they and others have suggested, that in these cases the bacilli vegetate in the gall-bladder, from which they are intermittently ejected into the intestines. The practical conclusions they arrived at, from the point of view of prophylaxis, were that a person who is found to be a typhoid carrier should be kept constantly under bacteriological supervision, and they suggest that possibly many typhoid epidemics might be avoided if the excreta of recovered typhoid cases were systematically examined (once a month) up to six months after recovery. These cases give point to McCrae's observation that "typhoid bacilli do not naturally inhabit water or milk; they may exist in these for a time and even multiply, but their *natural dwelling-place* is man, and these are only carriers from one host to the next."

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* "Typhoid Carriers," by Alexander Ledingham and J. C. G. Ledingham, *British Medical Journal*, January 4th, 1908.

The principle of prophylaxis, in dealing with an actual case of typhoid, is to destroy the vitality of the germs discharged from the intestine or bladder as soon as possible, and so prevent the infective organism being conveyed into the soil-pipes and drains, or otherwise disseminated.

In the case of a typhoid fever patient who is nursed at home, and not removed to a hospital, the following rules should be observed as closely as practicable: The patient should be isolated as completely as possible from the rest of the household, and only those in attendance upon him should be admitted into his room. Great cleanliness should be observed by the attendants, who should keep their hands frequently washed in carbolic lotion (1 per cent.), and should wear cotton or easily-washable dresses, which should be frequently changed, and discarded and cleansed immediately if accidentally soiled by discharges from the patient. The bed-room should be preferably without carpets, curtains, or hangings of any kind, and should be kept well ventilated. The bed or beds (for it is best to have two side by side, so as to be able to move the patient easily from one to the other for cleansing purposes, etc.) should be in the middle of the room, not in a corner. The motions should be received in a bed-pan and disinfected as soon as passed. There are various ways of doing this. For an emergency, and in the absence of other disinfectants, *boiling* water may be used in the proportion of four or five times the bulk of the discharge; but this should not be trusted to when other disinfectants can be obtained. The best disinfectants for this purpose are—a 5 per cent. solution of chloride of zinc; *fresh* chloride of lime used freely; or "milk of lime" added very freely to the dejecta To prepare this milk of lime, *freshly* burnt lime 100 parts should be allowed to soak up slowly 60 parts of water, and this hydrate must be kept in a tightly closed vessel, so that it may not absorb CO_2 and so become useless. One part of this is mixed with 8 parts of water. Corrosive sublimate solution with excess of hydrochloric acid, when used of sufficient strength, is also very effectual, but it has two disadvantages—it is highly poisonous and it corrodes metal drain pipes. Burying the fæces without disinfection must not be thought of, as the typhoid bacillus maintains its vitality even nine feet below the surface. Whatever disinfectant is chosen it should be used very freely, and thoroughly mixed with the evacuations (any solid masses being broken up) and kept in contact with them for a time (at least an hour) before they are thrown away; a little should always be put in the bed-pan before it is used. Urine passed by itself should be mixed with double the quantity of 5 per cent. carbolic and allowed to stand for an hour; after the second week bacilli in the urine have been found, often in great abundance, in one-fourth of the cases. Disinfection of the urine should be continued until typhoid bacilli can no longer be found in it.

Great care must be taken with regard to *soiled* linen, and mattresses must be suitably protected from penetration by the discharges. The body and bed linen, before removal from the bed-room, should be put into a 5 per cent. solution of carbolic acid, and at once conveyed to the laundry and plunged in boiling water, kept there for half an hour, and then washed with soap. The bath water should also be disinfected, by *fresh* chloride of lime, about ½ lb. to an ordinary tub, for an hour. The bed-clothes must not be shaken; those that do not come in contact with the body of the patient should be aired for eight hours daily. The feeding vessels should be frequently cleansed with boiling water, thermometers isolated and kept in 1 : 1,000 perchloride solution, which should be frequently renewed. Rectal tubes and syringes should be isolated, and the former boiled after use. After action of the bowels the patient's nates should be cleansed with moist carbolised tow or cotton-wool, which should be immediately burnt. So far as is possible, flies should be kept out of the sick-chamber. After the cure or departure of the patient, the air of the room may be disinfected by burning sulphur in the proportion of 5 drams to each cubic metre, the room being hermetically closed for twenty-four hours. The floor and woodwork of the room should be washed, and all dust removed by wet cloths wrung out in 5 per cent. carbolic or 1 : 1,000 sublimate solution. The room should be exposed to the air for at least a week after disinfection and before reoccupation.

As a further measure of disinfection, which is also refreshing and useful to the patient himself, we have recommended that his body should be lightly sponged all over, twice a day, with the following cooling, disinfecting, and aromatic lotion :—

℞ Thymol	gr. xl.
Spiritus lavandulæ	℥ij.
Spiritus vini rectificati	āā ℥iij.
Acidi aceti diluti	
Aquæ rosæ	...ad ℥xvj.

Misce, fiat lotio.

His skin is thus kept cleansed from contamination by excretions, and a cooling tonic influence is produced. It is also advisable to disinfect the mouth two or three times a day by washing it out with some Listerine and water (1 in 10 or 20). If the patient is unable to do this for himself, the nurse should cleanse the gums and teeth by means of a bit of cotton-wool tied to the end of a stick (which should be burnt after using) dipped in the mouth wash.

The air of the sick-room is agreeably freshened by placing pieces of blotting-paper, saturated with eucalyptus oil or pinol, on plates about the apartment. All food and drink should be carefully protected from *flies* and *dust*, especially in camps, and at all times and in all places during the prevalence of an epidemic.

Having established these prophylactic measures, we may next consider what are the indications which should govern the medical management of the patient. We would suggest that there are two plain indications in the treatment of this disease. The one we would call *general*, because it applies to all acute febrile maladies, and the other *special*, because it applies in an especial manner to the disease we are now considering.

The *general* indication is of great importance; it is to support and strengthen the resisting powers of the organism while it is passing through a serious crisis. The *special* indication is of not less importance; it is to diminish the gravity of this crisis by opposing and counteracting, in whatever way we can, the morbid activities of the specific microbe with which the organism has become infected.

We will first consider the best means of carrying out the **general indication**—that is, the maintenance of the patient's strength.

The patient should be kept absolutely at rest in bed from the commencement of the fever. Removal to any distance, as for the sake of being nursed at home, must be resisted. The physical effort and exhaustion attending a long journey, in the early stage of the fever, have compromised many chances of recovery. The bed should be arranged so as to be thoroughly comfortable to the patient. The mattress must not be *hard*, or bed-sores may soon be induced. "A woven-wire bed, with soft hair mattress, upon which are two folds of blanket," will be both smooth and elastic. A waterproof cloth should be under the sheet. The patient should not be exposed to a glaring light; at the same time, it is quite needless to darken the room so much as is often done. In hot weather the air of the room may be cooled by means of a block of ice; in winter it should be kept at about 65° F. One or two good nurses will be required, according to the severity of the case. Great cleanliness of the body of the patient should be enforced by regular cold or tepid sponging with water or with the lotion we have already mentioned. It is as well to cut the hair short in severe cases, since it is apt to fall out during the illness, and cold applications to the head can be better applied, if they are needed. The value of two beds —one for day and the other for night—has been mentioned; it greatly favours cleanliness, it refreshes the patient, and it gives the opportunity of some little change of position, which, in protracted cases, may avoid the formation of bed-sores. The state of the bladder should be noted in cases with defective consciousness, and the urine withdrawn by catheter if necessary.

The question of **diet** is a most important one. We have elsewhere * considered at length the dietetics of fever, and we may repeat here the two principal rules that we have there formulated: 1st, to endeavour to utilise food, as far as is safe and possible, for the purpose of checking the waste of tissue associated with the febrile process; 2nd, to administer no food that cannot be readily absorbed and assimilated. Seeing that the functions of the digestive organs are gravely impaired, if food is given that the patient is unable to assimilate, it will decompose in the stomach and intestines, become a local irritant and augment the fever, and add seriously to his discomfort and danger.

The popular tendency is to **over-feed** the typhoid patient. As McCrae truly observes, "there is little danger, in a severe attack, of the patient receiving too little nourishment." In the acute stage of fever scarcely any food is digested. The function of digestion is, in severe cases, practically in abeyance. Fluids that

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* "Food in Health and Disease," part ii., chap. i.

remain fluid within the alimentary canal can alone be absorbed. Excess of zeal in feeding fever patients is the cause of much of the intestinal trouble that complicates these cases. Strong meat extracts, milk, wine, brandy, beaten-up eggs, gruel, etc., are given the patient in rapid succession, to accumulate in his intestinal canal and form a fermenting mixture, in which poisonous ptomaines may be formed; while pure cold water, one of the best of eliminators and antiseptics, and which should be given freely, is often withheld. Tympanites and painful flatulent distension of the bowels naturally arise from such feeding. In feeding a case of typhoid we should carefully note the digestive and absorptive capacity still retained by the patient, and the food should be kept within that limit. Excellent a food as milk is, it is a concentrated food,* and is apt to coagulate in the stomach and intestines into a *solid* curd, which may excite much irritation of the ulcerated and inflamed mucous membrane, and be passed by the bowel quite undigested. We should always be on the look-out for this, and in order to avoid it we should give the milk freely diluted with some alkaline water, such as Vichy or Apollinaris; or a convenient and cheaper plan is to give the nurse some powders, each containing 3 grains of bicarbonate of soda, 3 grains of bicarbonate of potash, and 3 grains of common salt, and let her add one such powder to each cup of milk and water. This will not only aid the digestion of the milk, but it will add to the food certain necessary salts which, in the absence of vegetable foods, the patient does not get.

If, notwithstanding these precautions, we find much diffused solid matter in the evacuations, consisting, as it usually does, of finely precipitated casein, it is best to discard milk as a food entirely.

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* Sir William Jenner pointed out that "a pint of milk contains as much solid animal matter as a full-sized mutton chop," and he protested against the practice of giving large quantities of milk to typhoid patients (*Lancet*, vol. ii., 1879).

Strong beef-tea is by no means a good food for the average typhoid patient, and when given with sweet port wine it probably forms a mixture most prone to cause flatulent fermentation in the intestinal canal. As the patient needs a large quantity of water, there is absolutely not the smallest excuse for giving these *concentrated* meat extracts. It is far better to give weak broths and light, clear, and dilute soups.

The blood in typhoid—at any rate during the height of the fever—is poor in water, and the free supply of pure water to the patient is an urgent duty.* It may be given, if preferred, in the form of barley-water (iced if the temperature is high), which contains a small amount of carbohydrate. Or it may be given in the form of home-made lemonade. It has been calculated that at least 80 ounces of water should be taken by the fever patient in 24 hours, or about 3 to 4 ounces every hour. As, however, his food will be all fluid, we may include it in the estimate. Food and drink (of which quite one-half must be pure water) should amount to about 4 pints in the 24 hours. In *severe* cases, during the day, from 8 a.m. to 10 p.m., food or drink should be given every hour —drink one hour and fluid food the next—about 4 ounces each time. This will consume 60 ounces, or 3 pints. The remaining pint should be given at convenient intervals through the night. Two to 3 pints of milk, or the equivalent of 2 to 3 pints of milk, will be an adequate allowance for most cases, and 2 pints of barley-water may at the same time be given.* If milk, however treated, disagrees, as it will with some patients, and curd of milk is found in the motions, it will be best to convert the milk into *whey*. This can readily be done by boiling each pint of milk with a tablespoonful or two of lemon-juice and straining through muslin, strongly expressing from the curd all that can be expressed. Or we may try whether diluted peptonised milk is well tolerated. If we use whey, then we can easily supply the albuminous constituent which we lose in the curd, by beating up a new-laid egg with two teaspoonfuls of brandy, and then adding 3 or 4 ounces of whey and straining. Two or three eggs may be given thus prepared in the day. Little other food than this is needed during the febrile period and before the period of exhaustion sets in. There can be no objection, however, to either of the following supplementary fluid foods and drinks in ordinary or mild cases: Light beef-tea, veal or chicken broth, clear consommé, peptonised gruel (strained), peptonised beef, chicken or milk jelly (made by adding a little isinglass to hot peptonised milk), calf's-foot jelly, butter-milk, albumen-water (made by beating up the whites of one or two eggs with a little water, then straining, and adding a little lemon or orange juice and sweetening with a little sugar; cold or warm water is added to 4 or 5 oz.), small quantities of tea, coffee or cocoa occasionally, orange and other fruit juice with water, iced champagne and seltzer water if the stomach is irritable; and for relieving the *dryness* of the mouth and throat a drink may be made of hydrochloric acid lemonade thus: 20 minims of dilute hydrochloric acid, two teaspoonfuls of glycerine, and a tablespoonful of syrup of lemons to a pint of water.

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* McCrae makes some strong comments on this point. He says "the need of large amounts of water is often forgotten, and it is not-sufficient to let the patient take water only when he desires it. There should be a constant endeavour to induce him to take larger and larger amounts. . . . There seems no doubt we can reduce the severity of the attack by giving large amounts of water. . . . To be certain that a typhoid fever patient is being given enough water requires constant efforts on the part of the physician and nurse. . . "There seems no doubt that the patients who are under this washing-out treatment are likely to have milder attacks." —Osler and McCrae's "System of Medicine," vol. ii., p. 212.

With regard to the administration of **stimulants** in typhoid, we do not approve of their *routine* use. Cases of moderate severity in young people do exceedingly well without any alcohol; indeed, we regard alcohol, in cases of moderate severity, as of far more use during convalescence than during the fever. There are very few cases that are not the better for a glass or two of port wine daily during the early part of convalescence.

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* If there should be much intestinal catarrh and diarrhœa, or if hæmorrhage has occurred, we have found it best to give, for a time, much smaller quantities of food, so that the intestine may not be irritated by the constant passage of food through it.

We should not give alcohol in the early stages unless some decided indication arises for its use, and we should begin with small quantities: 2 to 4 ounces of whisky or brandy, well diluted, in the twenty-four hours—*i.e.* a dessert- to a table-spoonful every three hours. Larger quantities may be needed when signs of great exhaustion appear, such as a weak, irregular pulse, feeble cardiac first sound, a dry, brown, tremulous tongue, sinking in the bed, muttering delirium, or a low, somnolent mental condition, with motions and urine passed unconsciously. As a rule, the older the patient the greater and earlier will be the need of stimulants.

Restlessness and sleeplessness at night will sometimes be relieved by a full dose ($1\frac{1}{2}$ to 2 ounces) of brandy or whisky given with the food. We have seen an ounce of brandy send a convalescent, sleepless patient to sleep in a few minutes. The spirits we use should be quite pure. Whisky and brandy are the best stimulants *during* the fever, port wine and champagne during convalescence.

We will next consider the **special** indication in the treatment of typhoid, and also the treatment of certain symptoms and complications. We have shown elsewhere that the idea of an **antiseptic** or **disinfectant** treatment of typhoid fever has long been in the minds of practical physicians, and is to be found in the writings of Murchison, Watson, Jenner, and others. What is known of the conditions prevailing in the intestines and bladder in typhoid fever seems to point to the necessity of adopting a method of treatment which will include, as an essential part of it, an attempt to realise **intestinal** and **vesical disinfection**, so far as is practicable and safe.

The influence of the specific infective bacillus in setting up serious structural changes, often leading to fatal consequences, in a certain portion of the small intestine, is well known; and it seems probable that these consequences may be contributed to, in a notable degree, by a loss of power of resistance, in the specifically diseased tissues, to the attack of *non-specific* putrefactive micro-organisms which are always present in abundance in the intestinal canal and may under the conditions we are considering assume extreme virulence; so that intestinal *disinfection* may be more needed to counteract the local injurious influence of non-specific than of specific micro-organisms. We also know that the activity of the typhoid bacillus is not limited to the intestine, but that it exists in the blood and other organs. If an antiseptic action could be safely exercised on the blood or its bactericidal power increased, it would certainly be a rational indication.

What means have we at our disposal for the purpose of carrying out these indications?

The chief antiseptic or disinfecting agents that have been used in the treatment of typhoid are the following: Quinine, chlorine, acetozone, iodine, iodoform, *urotropine*, calomel, corrosive sublimate, carbolic acid, creasote, guaiacol carbonate, the sulphocarbolates, sulphurous acid and the hyposulphites, perchloride of iron, salicylic acid, salol, boric acid, turpentine, oil of eucalyptus, thymol, camphor, the naphthols and naphthaline, resorcin, bismuth salicylate, sulphide of carbon, tannin, charcoal, etc.

We shall first describe the method in which, from prolonged practical experience, we have been led to place most confidence, and then briefly refer to others which have most evidence in their favour.

We have found, as Watson and Murchison did many years ago, that of all disinfecting remedies **free chlorine** is one of the most efficacious. "I have repeatedly found it," says Murchison, "to have a beneficial influence upon the abdominal symptoms." We use a solution made in the following manner: Into a 12-ounce bottle put 30 grains of powdered potassic chlorate, and pour on it 40 minims of strong hydrochloric acid. Chlorine gas is at once liberated. Fit a cork into the mouth of the bottle and keep it closed until it has become filled with the greenish-yellow gas. To hasten this you must keep shaking the mixture of acid and chlorate, and you may also stand the bottle in hot water. Then pour water into the bottle, little by little, closing the bottle, and well shaking, at each addition, until the bottle is filled. You will then have a solution of free chlorine, together with some undecomposed chlorate of potash and hydrochloric acid, and probably one or two bye-products.

If the bottle is filled too rapidly with water, the chlorine will be driven out of the bottle by the water instead of being dissolved in it.

To 12 ounces of this solution, for an adult, we add 24 to 36 grains of quinine and an ounce of syrup of lemons, and we give half an ounce to an ounce every two, three, or four hours, according to the severity of the case and the age of the patient.

Smaller doses must be given to young children, and the mixture may be further diluted with water if it is found too pungent. We have prescribed this mixture for many years in a great number of cases of typhoid fever in hospital and private practice, except in those mild cases in which there is obviously but little general infection, and which really need little other treatment beyond careful nursing and feeding.

In giving this mixture to a typhoid fever patient, one of the first results you will notice is a remarkable cleaning of the tongue. You will scarcely ever find a dirty, thickly-coated tongue in a patient who has been *early* put on this mixture. Too frequently, however, cases are admitted into our general hospitals after many precious days have been lost, and the patient's chances of recovery are seriously imperilled by this delay. Another most important change has been noticed again and again and reported to us by the nursing sisters in our hospital : it is that the fœtor of the evacuations, which has often been very offensive, will usually disappear within twenty-four to forty-eight hours of the commencement of this treatment. Some of this mixture seems to pass through the intestine, in its whole length, for the hospital sisters report in certain cases a distinct odour of chlorine in the stools. But much of this mixture is, no doubt, absorbed into the blood, and in this way we not only obtain *intestinal* but also a certain amount of *general disinfection.*

Those who have objected to the use of **quinine** in typhoid fever have only objected to the enormous doses which have been advocated by some physicians —doses capable of producing toxic effects. We have never given such doses, nor have we ever found it necessary to exceed the very moderate doses we have here mentioned. We may state, in this connection, that we have found the efficacy of quinine in febrile states very much influenced by its mode of administration, and we have especially noticed this in giving quinine in pneumonias and in influenza. If we prescribe the quinine dissolved in citric acid, and given in effervescence by adding it to an alkaline mixture, doses of 2 or 3 grains will often be found to exert a powerful antipyretic influence, far greater than that obtained by the same quantity of quinine given in the dry state.

We consider this observation as to the action of quinine important, because we have seen reason to believe that, in infective fevers, if quinine be given in saline solutions, it is an active and reliable *antitoxine.*

It is an error to suppose that *very large* doses of quinine are needed in such cases.

The following good effects have appeared to us to frequently follow this *antiseptic* or *disinfectant* method, and we have published the particulars of cases so treated elsewhere.

1. A modification and sustained depression of the febrile temperature. 2. An abbreviation of the average course of the fever. 3. A remarkable maintenance of the physical strength and intellectual clearness of the patient, so that there has been far less need of stimulants. 4. A greater power of assimilating food. 5. A remarkable cleaning of the tongue. 6. A deodorisation of the evacuations. 7. A more rapid and complete convalescence.*

In short, it seems to exert an *antitoxic* influence in many cases. But cases will be encountered which are not influenced favourably by this treatment, especially those which come under treatment *late* and those in which constipation is a prominent symptom.

We are disposed to refer the effect on the temperature to the influence the chlorine and quinine exert on the activities of the infective organisms, or on the results of these activities, the *toxæmia*; for, unlike the effect of mere antipyretics, the temperature does not fall immediately; it usually takes about forty-eight hours before this treatment notably affects the temperature.

The free hydrochloric acid in the mixture is also of undoubted value. It is an antiseptic, and an acid condition of the intestinal contents is hostile to bacterial life. Bouchard thinks, as we do, that quinine acts as a *general* antiseptic, and it has indeed been found to check the culture of the typhoid bacillus. Grancher tested its effects, especially in typhoid in children, and found them "remarkable"; and he also believes it to have a specific antiseptic action in this disease. Curschmann† says he "still prefers quinine" to other antipyretics in typhoid; and Liebermeister, Voit, Pécholier, and many others have borne testimony to the value of quinine in this disease.

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* Since the publication of the first edition of this work many correspondents, at home and abroad, have written corroborating these statements from their own experience.

† Nothnagel's "Encyclopaedia of Practical Medicine," art. "Typhoid Fever" (English edition), p. 461.

The antiseptic action of **calomel**, which has been given by many physicians in cases that are seen at the very onset of the disease, may be in part due to its direct bactericidal effects, and in part to its purgative action, sweeping the intestine clean of decomposing ingesta and of putrefactive bacteria. Liebermeister gave calomel to every case that came under treatment before the ninth day of the fever—a dose of 8 grains three or four times in the first twenty-four hours—and he found he had better results than before. He found that it shortened the duration and lessened the intensity of the disease. If we see cases of typhoid quite early, and if there is no abdominal tenderness and diarrhœa, it is as well to begin the treatment with one or two doses of calomel (2 to 3 grains), for, by clearing away foul matters from the bowels at first it will be much easier to maintain intestinal antisepsis afterwards, especially if we avoid irrational and injurious over-feeding; and we shall have less hesitation, in a more advanced stage, in keeping the bowels absolutely at rest, as is positively necessary when certain complications threaten. It has been said that "purgation and antisepsis are, to some extent, interchangeable terms." An aperient expels the toxic ptomaines and other decomposing substances from the intestinal canal, and, if given in quite the early stage, may actually prevent subsequent serious diarrhœa.

But it should be always kept in mind that the use of aperients, to be perfectly safe, must be limited to the first few days of the fever. Indeed, unless constipation is a prominent feature, we would limit their use to the initial cleansing of the bowel; for *rest* of the inflamed intestine is also an important condition of safety. For which reason some authorities are opposed to purgatives at any stage. The great risk in giving aperients in the latter stages is the possibility of the existence of deep ulceration in the ileum; and in that case, as Sir William Jenner has pointed out, an aperient may mean the difference between life and death to the patient. At that period of the disease intestinal antisepsis can only be safely secured by the use of other intestinal antiseptics.

It is of historical interest to note that very brilliant results were obtained many years ago by Dr. Wilks, of Ashford, during a severe outbreak of typhoid, by the use of *sulphurous acid.*[*] He gave the acid in doses of 3 to 20 minims, according to the age of the patient, every four hours, for a week or ten days or longer; the larger dose for adults. "Of the 171 cases who took sulphurous acid, not one lost his life, and there were few who were not convalescent within fifteen days of commencing the treatment."

Bouchard, whose criterion of an intestinal antiseptic is insolubility, so that it may not exert any toxic or irritant action on the stomach, or be absorbed there, commends β-naphthol for this purpose, reduced to a fine powder, and mixed with *salicylate of bismuth.* One hundred and fifty grains of β-naphthol are mixed with 75 grains of salicylate of bismuth, and this is divided into thirty powders. From three to twelve of these are given in the twenty-four hours, enclosed in a wafer and swallowed with the food. The β-naphthol has the advantage of being very slightly soluble in water, but it is a powerful antiseptic; it therefore reaches the intestine, where it acts as an intestinal disinfectant.

M. Maximovitch recommends α-naphthol as preferable to β-naphthol. It is three times less toxic; and as to its antiseptic value, he found 1 part in 10,000 would prevent the development of the typhoid bacillus, as well as that of many other septic microbes in ordinary cultivation fluids.

Dr. Teissier, of Lyons, also prefers α-naphthol for producing intestinal antisepsis in typhoid fever. He gives it in 6-grain doses, combined with salicylate of bismuth, and he at the same time promotes free diuresis by cold water enemata.

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[*] Published in the *British Medical Journal* so long ago as 1870.

Thymol is preferred by some; it is innocuous in full doses, and possesses an antiseptic power four times as great as that of carbolic acid. It is insoluble, so that it is certain to reach the small intestine.

It may be given in doses of 2 to 3 grains every three hours, made into a pill with soap powder and a little spirit, and these should always be given with the food.

Pure carbolic acid was warmly advocated by the late Professor Charteris in the treatment of typhoid. Surgeon-Lieutenant-Colonel Quill * has used, in India, a combination of *carbolic acid and chloroform* in the treatment of enteric fever, and he writes enthusiastically of the results he and others have obtained from this method, combined with great care in feeding. The mixture he prescribes consists of 36 minims of Calvert's *pure* carbolic acid, 2 drams of spirit of chloroform, 3 drams of compound tincture of cardamoms, 2 ounces of syrup of hemidesmus, and chloroform water to 12 ounces. Of this he gives an ounce, with an equal quantity of iced water, every second hour, for five doses on the first day, for seven doses on the second day, and for ten or twelve doses on the third and following days. When the temperature has fallen and the general condition of the patient has improved, the doses are gradually diminished in frequency, but not wholly discontinued, until the temperature has been normal for a week. "One patient," he says, "took from first to last over 2 ounces of carbolic acid, with the same quantity of chloroform," without the manifestation of any toxic symptoms. He considers the doses given by other practitioners have generally been too small; "to be effectual the acid must be given in full doses at short intervals."

Carbonate of guaiacol has been given by Hölscher, of Mülheim, in doses of 15 to 30 grains, twice a day, and he states that sixty cases have been so treated without a death.

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* *British Medical Journal*, April 28th, 1894.

Turpentine is recommended by H. C. Wood as of especial value about the end of the second week, when there are signs of progressing intestinal ulceration. His formula will be found at the end of the chapter. He considers its volatility a great recommendation, as the ulcerated surface is bathed by the antiseptic vapour.

Salol has been given largely as an intestinal antiseptic, but we have not found it of use in these cases. *Oil of eucalyptus* has been prescribed with remarkable results by Kesteven, of Brisbane; *camphor* by Janaway, of New York, and *creasote* by Pécholier, of Montpellier.

In all these instances the idea and the indication have been the same, and the good results reported are almost identical with those we have tabulated as derived from the chlorine and quinine treatment, which we still prefer.

A further example of the value and need of *disinfectant* treatment in typhoid fever has been afforded by the observations that have been made as to the value of *urotropine* in the treatment of the *bacilluria* that occurs in the later stages of the disease and during convalescence. In some cases the bacilli are so numerous in the urine as to render it turbid, when it displays a "curious shimmer" which has been thought characteristic. We have already called attention to its importance as an agent in disseminating the disease. It is sometimes accompanied by cystitis and pyuria, and seems to be analogous to the *cholecystitis* which occasionally arises as a complication or sequel of typhoid, and is known to be associated with the presence of a large number of bacilli in the gall-bladder. But what interests us especially, is the emphasis and stress which these observations give to the necessity, from many points of view, of promoting the idea of an antiseptic or disinfectant treatment of this disease. *Urotropine* is the antiseptic that has been found especially efficacious in dealing with the bacilluria. This drug is prepared by the action of ammonia on formic aldehyde, and it is believed to act by the liberation of *formalin* after its passage into the urine. Typhoid bacilli rapidly disappear from the urine when urotropine is given in 10-grain doses thrice daily. The turbid urine becomes quite clear in twenty-four hours, and a permanent cure is effected in a few days, although it is as well to continue the treatment for a week. But we have known it excite great bladder distress and irritation in some persons; we happen never to have encountered any symptoms of pyuria or cystitis at any time in the course of the fever or during convalescence when such antiseptic treatment as we have described has been carried out, and further observations will probably disclose the fact that the pursuance of rational *disinfectant* methods with regard to the intestines will lead to the avoidance of bacilluria.

Many of the milder cases, as we have already said, need no treatment beyond rest in bed and a careful diet; but by way of precaution we should begin by giving a mild calomel purge, and three or four doses of the quinine and chlorine mixture daily; and, even in the mildest cases, this treatment will often be found to shorten the attack and promote early convalescence; but as some patients, who scarcely feel at all ill, object to the taste of the chlorine mixture, it may, in such cases, be replaced by a grain or two of quinine given in hydrochloric acid lemonade.

We have still to consider the treatment of typhoid fever by **hydrotherapy**, and also the treatment of certain *complications*, such as high temperature, severe diarrhœa, hæmorrhage, perforation, etc.

With regard to the treatment of **high temperature**, we think it an error to regard the elevation of temperature in typhoid as a thing to be attacked as if it were itself the disease: it is but a sign of the intensity of the activities of the infective agent, or of individual sensitiveness to them, and we rejoice to see the temperature fall as a result of our treatment because we believe that we have lessened the virulence of the infection. We have attacked the cause, and the effect is weakened. But there is small ground for rejoicing over the effect of large doses of a depressing antipyretic which may lower the temperature several degrees for a few hours, only that it may rise again unless we re-administer the antipyretic in doses which are often really toxic. We therefore discard altogether the *depressing antipyretics*, or limit their use to certain cases of hyperpyrexia, when we may be precluded from the application of other and safer depressors of temperature. But unless the temperature keeps above 104° F., and the patient's general condition seems unfavourably affected thereby, we do not see any urgent indication for directing our treatment especially to the reduction of the temperature. But when the temperature keeps above 104° F., with but slight morning remissions, and our antiseptic measures fail in reducing it, we should certainly adopt some means of lowering it, as in itself an injurious symptom; but it must be remembered that some patients present a temperature reaction much in excess of that of others without being as severely attacked, and we have often seen young patients with a temperature ranging between 103° and 104° F. who have shown little other signs of illness.

But it is to the use of cold baths as a *routine* method of treatment that we would now refer. The following is the plan usually adopted. When the temperature rises above 102·5° F. a bath at 70° F. is given every third hour. "The patient remains in the tub for fifteen or twenty minutes, is taken out, wrapped in a dry sheet, and covered with a blanket. While in the tub the limbs and trunk are rubbed thoroughly, either with the hand or a suitable rubber. It is well to give the first one or two baths at a temperature of 75° to 80°. If the bath at 70° is not taken well, raise the temperature to 75° or 80°. . . . Food is usually given, sometimes a stimulant, after the bath. The blueness and shivering which often follow the bath are not serious features. The rectal temperature is taken immediately after the bath, and again three-quarters of an hour later." The first reflection that must occur to physicians of experience is, that if this *routine* cold bathing is applied to every case which has a temperature of over 102·5°, it is absolutely certain that it is not needed in a very large proportion of the cases so treated. In very many of the mild cases the temperature touches 103°, and to put all these into a cold bath, without exception, must appear to every thoughtful mind as irrational a proceeding as has ever been practised. Let cold bathing, as a method of treating typhoid fever, stand for what it is worth, and let it be applied in cases that seem to demand it—but do not let us be induced to use it indiscriminately and as a matter of routine simply on the strength of certain statistics the value of which we have no opportunity of testing.[*] Moreover, we have ourselves known the most serious and fatal results follow this routine method of cold bathing when applied to highly sensitive, nervous patients; and it involves the maximum of fatigue to the patient and the maximum of trouble to the attendants, while we can conceive of no routine plan of treatment better calculated to induce serious complications in otherwise mild cases. We have long been convinced that, as a method of routine treatment, it is borne much better by the class of patients who are found in hospitals than by the better class who are treated in their own homes.

But if, in order to combat the pyrexia, we wish to apply cold to the surface, we can do so in an effective manner without having recourse to the cold bath. The patient can be enveloped in a cold wet sheet for a minute or two, then rubbed over with dry towels; and when there are two beds, side by side, this is easily carried out. Or the surface of the body may be rapidly cooled by quickly and repeatedly passing over it a large smooth piece of ice enveloped in thin flannel, or a large sponge wrung out in ice-cold water, the patient being turned over on his side while it is being applied to the back, when it should be passed several times along the spine. Also an ice-bag may be applied to the back of the neck, and another to the head. A few ounces of ice-cold water may also be injected into the rectum from time to time. All these are useful measures for reducing hyperpyrexia and the nervous excitement and exhaustion connected therewith.

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[*] We are not fond of relying exclusively on the argument from statistics, but Dr. O'Connor, of Buenos Ayres, states that he has applied the method of treatment described at p. 689 in 100 consecutive cases of typhoid fever, and has only had two deaths. No results so good as this have been obtained with the *cold bath* treatment.

Although the routine cold bath method of treatment is at present widely advocated, we are by no means alone in condemning it as a *routine* treatment. Professor S. Smith Burt, of New York,* has remarked with regard to the tub bath, "Anything that puts such a strain upon a patient as to require free stimulation in consequence had better not be employed indiscriminately. A sponge bath of one-third alcohol and two-thirds cold water thoroughly carried out . . . will accomplish the desired result with considerably less expenditure of strength on the part of the patient."

Professor H. A. Hare† says, "I am opposed most strongly to the indiscriminate application of the cold plunge or Brand bath to every patient suffering from this malady. . . . It is, or ought to be, a fundamental law of therapeutics that there is no such thing as treatment by hard-and-fast rules of routine. The recommendation that all cases of typhoid fever with a temperature of 102° to 102·5° shall be placed in a tub of water at 65° to 70° is an affront to this rational law." In an elaborate estimate of the effects of the *plunge bath* he concludes that it causes (1) an unnecessary expenditure of the patient's strength, (2) an increased tendency to hæmorrhage, (3) the more frequent occurrence of relapses, (4) probably a prolongation of the duration of the disease, and (5) albuminuria in a large percentage of the cases.

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* *Medical News*, October 20th, 1900.

† "System of Practical Therapeutics" (2nd edition), vol. ii., p. 40.

Curschmann, although an advocate of "lukewarm" baths, is not in favour of their *routine* use. "Cases of severe onset," he says, "with symptoms of intense persistent intoxication, should from the outset be subjected to bath treatment . . . the conditions are different with regard to the mild or moderately severe cases. *These may not require the bath treatment;* diet, rest, and the systematic regulation of the remaining conditions are here generally quite sufficient. . . . In all cases of typhoid fever I have given daily one, possibly two, *cool or tepid spongings*, which are refreshing, and exert a favourable influence upon the nervous system." Most emphatic is his statement of the cases in which hydrotherapy is *contra-indicated.* "Every form of bathing treatment is strictly forbidden on the appearance of the first sign of intestinal hæmorrhage, as well as on the appearance of even the slightest degree of peritonitic irritation. The method is also dangerous in patients with weakness of the heart . . . also persons with arterio-sclerosis . . . pleuritic effusions . . . phlebitis . . . severe laryngeal lesions . . . old age, even persons between 40 and 50 . . . children bear very cold baths even worse than adults . . . chlorotic and in general anæmic debilitated individuals . . . obese persons; even in youthful persons of this character, particularly in 'blooming, thriving' young women, unfortunate experiences are not rarely encountered. . . . The great tendency to cardiac weakness often renders the baths dangerous also for alcoholics."*

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* Nothnagel's "Encyclopædia of Practical Medicine," art. "Typhoid Fever" (English translation), p. 458.

He also testifies that "furunculosis of the skin appears to occur with especial frequency at times when typhoid fever is vigorously treated with frequently repeated and exceedingly cold baths. Since I have abandoned this mode of treatment furunculosis has become less common among my patients."

When the temperature keeps persistently high we do not object to a few doses of phenacetin, the safest of the depressors of temperature, given in combination with quinine. We give quite small doses, but we have found them act well—2 grains of phenacetin with 1 grain of hydrobromate of quinine every hour until the temperature has fallen two or three degrees, then every two or three hours.

Next as to the treatment of **diarrhœa.** If we have followed the principles of intestinal disinfection already set forth; if we have commenced by sweeping the intestine clean by calomel or some other simple aperient; if we have cautiously regulated the diet so that no accumulations of food could possibly linger in the intestine to undergo fermentation and cause irritation from its presence; and if, notwithstanding, diarrhœa continues or arises, and is attended with abdominal tenderness and tympanites; and if on inspection we find the evacuations fluid and quite free from curd of milk or other undigested food, then we may conclude that it is due to the intensity of the ulcerative and catarrhal processes set up in the small intestine, and that the indication is to arrest it and keep the intestines as completely at rest as possible. Nothing does this so well as opium, and no mode of giving opium is so suitable as small enemata. We also prefer solid opium, which is absorbed slowly, to any liquid form, which is absorbed too quickly, and will, if a full dose be given, sometimes act unfavourably on the heart and nervous system. We give 5 grains of Dover's powder and 10 grains of tannin mixed with an ounce of gum mucilage, and we order this to be mixed with 1 or 2 ounces of warm water, arrowroot, or thin starch, and to be injected into the bowel with a long tube (8 or 10 inches in length) after each motion. For children we reduce the quantity of Dover's powder. Internally we should give salicylate of bismuth, 5 grains, with carbonate of bismuth, 5 grains, mixed up with a little mucilage and cinnamon water, and this may be given every three hours until the diarrhœa is relieved. Other remedies for this symptom will be found in the appended formulæ.

If there is much tympanites and abdominal tenderness, a flannel sprinkled with a mixture of equal parts of opium and turpentine liniment should be kept applied to the abdominal surface. The careful passage of a rectal tube is occasionally needed to relieve excessive distension brought on by unsuitable and excessive feeding. Turpentine enemata may be needed for the same purpose. Flatulent distension of the stomach is occasionally a distressing symptom, and may necessitate the passage of the stomach tube for its relief.

Hæmorrhage is a very serious symptom, and calls for prompt measures for its arrest; its occurrence is often indicated by a sudden fall of temperature. No treatment is so serviceable as the arrest of all intestinal movement. We must do our best to keep the intestine absolutely at rest. We have been able to keep the bowels inactive and completely at rest for more than fourteen days in order to avoid the danger attending a recurrence of serious hæmorrhage, and then we have only allowed the bowels to act after an enema of olive oil.

On the occurrence of hæmorrhage we use immediately the enema of Dover's powder and tannin we have just referred to, but we increase the dose of Dover's powder to 10 grains. Indeed, in all cases of typhoid we usually order such enemata to be kept ready at hand, to be administered immediately if hæmorrhage occurs. We are satisfied that lives have been saved by this precaution. At the same time we order the following mixture by the mouth:—

℞ Acidi sulphurici aromatici ... ... ʒj.
Liquoris opii sedativi ... ... ♏xv.
Aquæ cinnamomi ... ... ad ℥vj.
Misce, fiat mistura. Two tablespoonfuls every hour for six doses, and then every three hours.

We allow no food that can leave any unabsorbed residue, and all food should be given cold, and we allay thirst by means of small quantities of iced water. A soft, broad flannel binder applied firmly, but not tightly, around the abdomen no doubt helps to keep the intestines at rest and still. Some physicians give *calcium* salts as a prophylactic measure. The coagulation time of the blood is taken in all patients, and if it is prolonged 10 grains of *calcium lactate* is given thrice daily. Some give it after hæmorrhage has occurred; we cannot say we place any great reliance on this measure ourselves.

In protracted hæmorrhage we have found turpentine very useful—two capsules of 3 minims each every four hours. It has the advantage of being both styptic and antiseptic.

Perforation *of the intestine*, indicated by sudden very severe pain, collapse, fall of temperature, and signs of peritonitis, requires immediate recourse to operative measures. This offers almost the only chance of recovery. Laparotomy should be performed, the opening in the bowel found and closed, and the peritoneal cavity cleansed. The earlier the operation is performed the better are the results to be expected. If, for any reason, operation is not practicable, full doses of opium (or morphine hypodermically) should be given to lessen the effects of shock and relieve the extreme suffering.

In addition to the special dangers of hæmorrhage and perforation in the advanced stages of this disease, one of the most serious conditions affecting the safety of the patient which arise at that period is progressive *heart failure* with *hypostatic congestion of the lungs*. This condition may require to be dealt with by energetic and sustained stimulating and tonic measures. Alcohol must be given freely, but with judgment, and it must be remembered that the alcohol we administer has to be eliminated, and that the organs of elimination are not in the best state for the due performance of their functions. We prefer small and frequent doses rather than large quantities at a time, and we mix them with other cardiac stimulants, such as a strong and fresh infusion of coffee, which is too little used in such circumstances. Strychnine, given hypodermically, is one of our best resources in these cases of cardiac asthenia; beginning with doses of $\frac{1}{60}$th grain, we may increase them rapidly, if necessary, up to $\frac{1}{16}$ grain every four to six hours. Caffeine is also a valuable cardiac stimulant at such times, and it also is best given hypodermically. Five grains, dissolved by the aid of 5 grains of sodium benzoate in 20 minims of warm distilled water, may be injected three or four times a day if needful. Hypodermic injections of ether or of ethereal solutions of camphor (Curschmann prefers solutions of camphor in olive oil) have also long been used for the same purpose. Digitalis is recommended by some physicians, but we prefer caffeine and strychnine as cardiac stimulants at such times. **Thrombosis** when it occurs usually affects the veins of the lower limbs, especially the left. The leg must be elevated and bandaged from the foot upwards. If the thrombosed vessel is painful, equal parts of extract of belladonna and glycerine may be applied frequently. It has also been found of use to give 10 grains of sodium citrate daily.

Nervous symptoms, as delirium, insomnia, restlessness, etc., are, as we have already pointed out, usually associated with hyperpyrexia or a sustained high temperature, and they must be met by such measures for lowering the temperature as we have described. But when typhoid fever attacks persons of neurotic temperament we may find, from the first, that nervous disturbances manifest themselves independently of high temperatures; such patients require sedatives to quiet nervous excitability. Opium has been objected to in such cases on the ground that it favours cerebral congestion, and chloral with potassium bromide at night to relieve restlessness and insomnia has been preferred. We make no objection to the chloral and bromide, but no drug quiets the constitutional nervous unrest like opium. A draught may be given at night containing 10 to 20 minims of liquor opii sedativus with 30 minims of spirits of nitrous ether and 30 minims of sal-volatile in an ounce of camphor water. We have, however, at times seen opium, given for this purpose, appear to cause a rise of temperature, possibly by checking elimination. We have then given with advantage a draught containing 15 grains of sodium bromide and 20 minims of tincture of henbane in an ounce of camphor water. In very severe cases of maniacal delirium full doses of morphine hypodermically may be needed. *Lumbar puncture* is advised by McCrae in "all patients with delirium or profound stupor. It is important for diagnosis but also for treatment. If fluid is obtained on puncture it may be allowed to run as long as it comes with any pressure, but it is probably well not to withdraw more than 20 c.c. at one time. The puncture may be repeated daily if necessary, but the amount of fluid obtained and the relief given are the best guides for its repetition."

Careful nursing and cleanliness will prevent the occurrence of **bed-sores.** In protracted cases, in addition to sponging the back frequently with cold water and thoroughly drying, the application twice a day to the prominent parts of a lotion of rectified spirits with 10 grains of tannin to the ounce is a good precautionary measure.

The stage of **convalescence** in typhoid requires the most careful watching. Bearing in mind the anatomical intestinal lesions characteristic of this disease, we shall realise the fact that, for some time after the cessation of the fever, there may be only a thin layer of peritoneum between life and death to the patient.

It is this *hurt* intestine that we have to think of; and it is best to be frank with the patient's friends and explain to them without any mystery the real state of the case. The craving for solid food must therefore be steadily resisted, and for ten or twelve days after the temperature has become normal no solid food should be given. The rise of temperature which is often excited during convalescence by solid food or by even too much liquid food is sometimes spoken of as a mysterious thing; it has been termed "febris carnis" and "febris cibi." We believe the true explanation to be that if food is given leaving much fæcal residue, the ordinary fæcal toxines will be formed, and these will be readily absorbed by the yet unhealed, or incompletely healed, ulcerated intestinal surface, and a rise of temperature will follow. The same will sometimes occur, and for the same reason, if constipation is allowed to go on, unrelieved, during convalescence; and we have often shown, in cases in the hospital, that the administration of an enema of soap and water and olive oil, after it has produced an action of the bowels, is at once followed by a fall of the temperature to normal. We are therefore in the habit of securing a daily action of the bowels by such an emollient enema. Should some tendency to diarrhœa continue into the convalescent period, from a lingering intestinal catarrh, it should be checked by bismuth, the carbonate or salicylate. Nothing promotes rapid convalescence and return of strength so much as reclining for many hours a day in the open air—of course, in favourable weather. Some stimulant is usually needed during convalescence, and good, sound port wine mixed with an equal quantity of water is the best.

The treatment of *relapses* must be conducted on the same principles as that of the original attack. They probably arise from re-infection by bacilli within the body, as, for instance, in the gall-bladder, the patient not having been rendered immune by the attack.

TYPHUS FEVER

Cases of typhus fever are now rarely seen in England, either in *general* hospitals or in private practice; we shall therefore deal briefly with this subject. The specific germ of typhus has not yet been discovered, although several micro-organisms have been described as associated with it, and as the disease seems to be disappearing before the improved sanitary conditions now so generally enforced, there is perhaps less chance of an early discovery of the actual specific infective germ. Typhus fever is one of the most contagious diseases, resembling in that respect the acute exanthemata. It spreads by direct contact from the sick to the sound, and has, in former times, proved a very fatal disease to the physicians and nurses engaged in attending its victims. The poison adheres tenaciously to articles which have been in contact with the patients (fomites), and seems to be given off in the breath and exhaled from the skin. Overcrowding causes the poison to acquire great virulence, while free ventilation greatly reduces the risk of infection. It is especially a disease of poverty, overcrowding, and defective ventilation and sanitation, and it used to be commonly met with in overcrowded, ill-cared-for dwellings, prisons, camps, and wherever human beings were crowded together in misery, want, and dirt. It used to be common in the jails of this country in the eighteenth century, and was known as "jail fever," and as recently as 1893 the overcrowded prisons in France were visited by an outbreak. It is a very fatal disease when it attacks those over middle age, but the mortality is low in those attacked under twenty.

The *incubation* period seems to vary with the intensity of the infection from a few hours to two or three weeks—twelve days is said to be the average.

The onset, unlike that of typhoid, is sudden, with rigors, headache, often very severe, and pains in the back and limbs and great depression. The temperature rises rapidly and may reach 104° the first night, and there are the usual symptoms of pyrexia—thirst, furred tongue, quickened pulse, flushed face, tremors, and tendency to early setting in of delirium. The temperature reaches its maximum on the fourteenth day (or night), and may rise to 106° F.; the morning remissions are less than in typhoid. There is usually *constipation*, and the urine is scanty, dense, and high-coloured, with an excess of urea and uric acid and a diminution of chlorides, and it often contains albumen. The characteristic *rash* of typhus usually appears on the fourth or fifth day; it consists of two elements, "a fine, irregular, dusky-red mottling" and distinct papular rose spots, which change to petechiæ. These spots are permanent, and persist till the crisis, and do not come out, in successive crops, like the eruption in typhoid.

The delirium and restlessness are troublesome symptoms. The delirium is more commonly quiet and muttering, but may be noisy and violent. Symptoms of excitement pass, as the disease advances, into nervous depression, stupor, and extreme prostration. In cases that recover, usually on the fourteenth day, the temperature falls rapidly (by crisis), the patient passes into a deep sleep, and awakes free from fever, though extremely weak, and recovers rapidly. In fatal cases the patient dies in a state of coma about the fourteenth or fifteenth day, the temperature rising to 106° or higher. In milder cases with only slight nervous disturbance the crisis may occur on the twelfth day or earlier. Relapses are very rare, and one attack usually, but not invariably, protects from others. Serious complications and sequelæ are common—pulmonary congestion, lobular pneumonia, bronchitis, thrombosis of veins of lower limbs, embolism leading to gangrene, bed-sores, suppurative parotitis, and secondary abscesses.

This brief sketch of the usual course of typhus fever must serve as an introduction to the consideration of its **treatment.** The needful prophylactic measures will be obvious. Should a case of this disease be encountered, it must be isolated and dealt with on the principles we have already repeatedly referred to in the preceding chapters on infectious fevers.

The removal of those attacked to well-ventilated apartments or to suitable shelters in the *open air*, and the thorough disinfection of the places or buildings in which the fever has broken out, are of the utmost urgency. The nurses should be young, or selected from those who have been rendered *immune* by previous attack. The medical attendant should wear a special wrap when visiting these cases, and should avoid any unnecessarily close contact with the patient as well as breathing the atmosphere around his person and bed-coverings. Convalescents should be provided with new, or thoroughly disinfected, clothing, and must be regarded as infective for a month from the onset of the illness. They should have several disinfecting baths.

There is usually more urgency for early and active stimulation and supporting treatment in typhus than in typhoid, as this disease runs a much shorter course and usually terminates by crisis on the fourteenth day. We should give frequent small doses of quinine, in effervescence, or in solution in hydrobromic acid, from the beginning, and adopt such means of reducing hyperpyrexia as we have already dwelt upon. Acidulated water should be freely given to allay thirst, and for this purpose a drink made with syrup of lemons and dilute hydrochloric acid is most useful. A dram of the dilute acid and an ounce of the syrup may be added to a pint of water, and this may be drunk almost *ad libitum.* Head symptoms and delirium are far more common in typhus than in typhoid, and shaving the head and the constant application of an ice-cap are much more necessary. In the early days chloral and bromide of potassium may be given to procure sleep, which is an urgent indication ; but later it is perhaps best to trust to full doses of alcohol for the purpose, as cardiac asthenia is then a serious complication. Graves gave opium combined with tartar emetic — 4 minims of tincture of opium with $\frac{1}{4}$ grain of tartar emetic in a tablespoonful of water every two hours until sleep was induced. If opium is contra-indicated, as when there is much pulmonary congestion, a hypodermic injection of $\frac{1}{200}$ grain of hyoscine may be safer.

Open-air treatment when practicable has been found very advantageous. Curschmann observes: "I cannot say too much in favour of the open-air treatment. . . . The patients became quiet, and the symptoms of the initial stage—the violent headache and insomnia—were more favourably influenced by the open-air treatment than by any other means," while it afforded "the most effectual means of guarding against the spread of the disease."* In the Lille-Paris epidemic of 1893 the mortality became greatly reduced by moving the patients into the garden and treating them in the open air.

For the great nervous prostration camphor (gr. iv) and musk (gr. x) has been prescribed with benefit. Hypodermic injections of strychnine and ether have been given in cases of collapse, and recourse may be had to all the measures we have repeatedly mentioned in previous chapters for maintaining the circulatory force. Curschmann speaks very highly of the hypodermic injection of full doses of camphor dissolved in olive oil—1 part of camphor to 5 parts of oil.

The *diet* may be more liberal than in typhoid, as we have no intestinal lesions to consider, but it will have to be limited, as in all acute pyrexias, by the tolerance and digestive capacity of the patients. Milk, gruel, arrowroot, clear soups and broths, beaten-up eggs, beef juice, jellies, and other light nourishment may be given. Alcohol should not be administered as a matter of routine, but kept in reserve for use when serious symptoms of asthenia approach. The occurrence of bed-sores must be provided against as we have directed in cases of typhoid.

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* Nothnagel's "Encyclopædia of Practical Medicine" (English edition), art. "Typhus Fever," p. 615.

ADDITIONAL FORMULÆ

Sulphurous acid mixture in typhoid

℞ Acidi sulphurosi, ʒij.
Syrupi aurantii, ʒiv.
Aquæ ad ℥vj.
M. f. mist. Two tablespoonfuls every four hours (smaller doses for children). (*Wilks.*)

Turpentine mixture for typhoid

℞ Olei terebinthinæ, ʒjss.
Olei caryophylli, guttas vj.
Glycerini }
Mucilaginis acaciæ } āā ℥ss.
Syrupi et aquæ ad ℥iij.
M. f. mist. A dessertspoonful every two hours during the day. (*Prof. H. C. Wood.*)

Eucalyptus mixture in typhoid

℞ Olei eucalypti, ♏v ad x.
Spiritus ammoniæ aromatici, ʒss.
Spiritus chloroformi, ʒss.
Glycerini, ʒss.
Mucilaginis et aquæ ad ℥j.
M. f. haust. To be taken every four hours. (*Kesteren.*)

Sulpho-carbonated water for typhoid

℞ Carbonis bisulphidi, ʒvj.
Essentiæ menthæ piperitæ, ♏l.
Aquæ, ℥xvj.
Shake well in a large bottle, and allow the bisulphide of carbon to settle. Use only the clear watery solution, and renew the water as it is used. Eight to ten tablespoonfuls daily to be given in tablespoonful doses mixed with half a glass of milk. (*Dujardin-Beaumetz.*)

Iodine and carbolic acid mixture

℞ Acidi carbolici, ♏xij.
Tincturæ iodi, ♏xvj.
Tincturæ aurantii, ʒjss.
Syrupi, ʒiij.
Aquæ ad ℥viij.
M. f. mist. Two tablespoonfuls every four hours. (*Grimshaw.*)

Diarrhœa mixture in typhoid

℞ Plumbi acetatis, gr. ij.
Acidi aceti diluti, ♏xv ad xx.
Morphinæ acetatis, gr. $\frac{1}{8}$ ad $\frac{1}{4}$.
Aquæ destillatæ, ℥j.
M. f. haust. (*Osler.*)

Another

℞ Acidi sulphurici aromatici, ʒiij.
Tincturæ opii, ʒijss.
Tincturæ catechu, ʒiv.
Aquæ chloroformi ad ℥x.
M. f. mist. Two tablespoonfuls three times a day, or after each liquid motion. (*Whitla.*)

Another

℞ Extracti opii aquosi, gr. jss ad iij.
Mucilaginis et aquæ ad ℥vj.
M. f. mist. A tablespoonful every two hours. (*Bamberger.*)

For diarrhœa of typhoid

℞ Bismuthi subnitratis, ʒj.
Morphinæ sulphatis, gr. j.
M. et div. in pulv. xij. One to four a day. (*Alonzo Clark.*)

For hæmorrhage in typhoid

℞ Ergotini, gr. xij.
Syrupi limonis, ℥ss.
Aquæ destillatæ ad ℥iij.
M. f. mist. A tablespoonful every hour. (*Bamberger.*)

Powders for the same

℞ Plumbi acetatis, gr. jss ad iij.
Opii pulveris, gr. jss ad iij.
Sacchari albi, gr. lx.

M. et divide in pulv. vj. A powder every three hours.

Or

℞ Aluminis, ʒj.
Opii pulveris, gr. v.
Sacchari albi, ʒij.

M. et divide in pulv. xij. One every three hours.
(*Bamberger.*)

Mixture for the same

℞ Acidi tannici, gr. x.
Tincturæ opii, ♏x.
Spiritus terebinthinæ, ♏xv.
Mucilaginis, ʒij.
Tincturæ chloroformi compositæ, ♏xx.
Aquæ menthæ piperitæ ad ℥j.

M. f. haust. To be taken every two hours.
(*Murchison.*)

Mixture for sleeplessness in typhoid

℞ Liquoris morphinæ hydrochloridi, ʒj.
Sodii bromidi, gr. xlv.
Syrupi aurantii, ʒiij.
Aquæ chloroformi ad ℥ij.

M. f. mist. Half to be taken at bed-time, and the remainder in three hours, if necessary.
(*Whitla.*)

Acid mixture in typhus

℞ Acidi nitro-hydrochlorici, ʒss.
Spiritus ætheris nitrosi, ʒiv.
Aquæ camphoræ ad ℥vj.

M. f. mist. A tablespoonful every two or three hours.
(*Hartshorne.*)

Stimulating mixture in typhus

℞ Pulveris moschi, gr. x.
Mucilaginis acaciæ, ʒij.
Syrupi aurantii, ʒij.
Aquæ camphoræ, ℥ss.

M. f. haust. To be taken every five or six hours.
(*Murchison.*)

Mixture for adynamic restlessness in typhoid

℞ Liquoris opii sedativi, ʒss.
Spiritus ætheris, ʒj.
Aquæ camphoræ ad ℥iij.

M. f. mist. Two tablespoonfuls every hour until sleep is induced. (*Murchison.*)

Sedative mixture in typhus

℞ Potassii bromidi, ʒiij.
Chloral hydratis, ʒj.
Aquæ ad ℥vj.

M. f. mist. A tablespoonful every two hours. (*Charteris.*)

Tonic mixture for convalescence in typhus

℞ Quininæ sulphatis, ʒss.
Acidi nitro-hydrochlorici diluti, ʒiv.
Tincturæ calumbæ }
Tincturæ quassiæ } āā ʒj.
Infusi aurantii ad ℥viij.

M. f. mist. A tablespoonful in a wineglass of water three times a day before meals.
(*Whitla.*)

CHAPTER V

TREATMENT OF INFLUENZA; OF MALARIAL FEVERS; AND OF TETANUS

INFLUENZA—Difficulties in its Investigation—Misleading Methods—Fatal Pulmonary Complications in the Feeble and Aged—The Avoidance of Serious After-effects of Chief Importance in Treatment—The Dangers of trusting too much to Analgesic and Antithermic Drugs—Need of Tonics from the first—Quinine as an Antitoxine—Cases—Many require no Drug Treatment—Certain Symptoms need Careful Management—Indications—To Antagonise a Bacillary Toxine—High Temperature, Headache, and Gastro-intestinal and Muscular Pains—Laryngo-tracheal Cough—Bronchitis and Pneumonia—Gastro-intestinal Catarrh—Cerebro-spinal Cases—Cardiac Asthenia—Some Remedies.

MALARIAL FEVERS—*The Plasmodium Malariæ*—Infection through Mosquitoes—Forms of Malarial Infection—Quinine the Specific Remedy—Various Modes of Administering Quinine—Management of the Attacks of Fever—The Intermittent, Remittent, and Pernicious Forms—Malarial Hæmoglobinuria—Malarial Cachexia—Prophylaxis.

TETANUS—A Bacillary Infection—Characteristic Symptoms—Treatment—Tetanus Antitoxine.

Additional Formulæ.

INFLUENZA

AN epidemic of **influenza**, which had not been known in Great Britain since 1847-48, re-entered England from the European continent at the end of 1889. It spread widely during the spring of 1890, was present in various parts of the country in the winter and spring of 1890-91, and at the end of the latter year and the commencement of 1892 assumed alarming proportions and was attended with great mortality. In December, 1893, it again appeared in a severe and widely-diffused form, and nearly every winter, or early spring, since then it has been more or less present.

Although the disease appeared in England at the end of 1889, it was not until the winter of 1891-92 that serious alarm began to be felt at its progress and its severity, and that due attention began to be paid to the gravity and variety of its **after-effects.** A disease which varies so greatly in its incidence on different persons, which arouses such a variety of morbid phenomena, in different organs, in those it attacks, and with regard to which the reaction of different constitutions to its specific poison is so varied, obviously presents special difficulties to the investigator. In a great number of instances, especially at the commencement of the epidemic, the attacks were so slight that no more attention was paid to them than to an ordinary cold.

But as the disease became better understood and the virulence of its attack, on certain organisations, fully realised, more serious concern as to prognosis was manifested by all physicians of experience and knowledge. The grave complications which often occurred, especially in connection with the organs of respiration, in feeble and aged people, were found to be attended with an alarmingly great mortality; and the serious circulatory and nervous disturbances, and the general and alarming asthenia which followed in its train, in many instances, led to a much more serious estimation of the seriousness of the malady.

And so in simple, uncomplicated cases of influenza, it came to be recognised that our treatment should be directed *especially* to the avoidance of those serious *after-effects.*

There are many remedies that will relieve the common early symptoms of influenza—the pain in the head and eyeballs, the pains in the back and limbs, the gastro-intestinal pains and occasional diarrhœa, the rise of temperature, the general depression and *malaise*; and there is no reason why they should not be relieved. But the very ease with which this may be effected is apt to mislead both the practitioner and the patient into the belief that what is so easy and pleasant must always be best. This is particularly the case with regard to such drugs as the salicylates, antipyrin, antifebrin, exalgin, etc. A dose of salicin or sodium salicylate, with acetate of ammonia, in a diaphoretic draught, will often relieve the early symptoms of influenza and bring down the temperature rapidly; and antipyrin also will relieve the headache and the gastralgia when they exist. Our predecessors, in former epidemics, accomplished the same with Dover's powder, together with nitrous ether and acetate of ammonia; but not so completely nor so quickly. And it is not against the early and occasional but against the continued and routine use of such drugs as sodium salicylate and antipyrin that we would protest. A few doses for two or three days may be useful, but we must then turn our thoughts to the after-effects of influenza, to the influence of the influenza toxine on the heart and the cerebro-spinal nerve-centres. We must try also to lessen the morbid activities of the characteristic micro-organism which is found in the mucus of the air passages. In view of the cardiac asthenia which follows in so many cases, it is advisable to be very cautious in the use of mere pain-killing and temperature-depressing drugs. They are very effective, and make a great impression on the patient and his friends, but they divert the practitioner from his most important duty—that is, to guard against "dangers *ahead*," and to give his patients suitable *tonics* from the first. There are those who speak of salicin as a tonic; but *most useful* as we believe this drug to be in the initial stage of the disease, we have had reason to regard it, when taken for long periods continuously and freely, as a cardiac depressant. One of the most frequent symptoms observed during convalescence from influenza is profuse, exhausting perspirations. Salicin, instead of checking, tends to promote this.

The remedy that is most deserving of confidence in the treatment of influenza, after two or three days of salicin treatment, is **quinine.** It seems to act like an *antitoxine* in this disease. Professor J. Tessier, of Lyons, compares its action, in influenza, to that of sodium salicylate in acute rheumatism; he regards it as the most valuable medicine we possess for the treatment of this affection. Dr. Gaillard, of the Hôpital St. Antoine, Paris, has expressed the same belief.* We are quite aware of the difficulties that arise in giving it to some patients. If the practitioner gives it unskilfully and incautiously, or *too soon*, he will often be tempted to discard it as unsuitable. Had it not been so hastily and unwisely set aside by many practitioners, we should have seen far less of cardiac asthenia and other troublesome sequelæ. The best and most efficacious way of giving it is in combination with citrate of potash and ammonia in effervescence, and at first it should be given in small or moderate (*not large*) doses, frequently repeated. From 1 to 3 grains dissolved in 10 to 20 grains of citric acid should be added to a mixture containing a sufficiency of ammonium carbonate and potassium bicarbonate to rather more than neutralise the citric acid. This dose should be repeated every three or four hours, and if there should be profuse exhausting sweatings in the afternoon or evening, a single additional dose of 5 grains of quinine dissolved in lemon-juice should be given at five in the afternoon. Taken in this form, combined with an effervescing saline and preceded by two or three days of salicin treatment, it will be rarely found to disagree even with most sensitive patients; and even if it should give rise to some headache or slight deafness, it is far better to bear with these trivial inconveniences than incur the risk of serious toxic after-effects. Many cases of influenza require little or *no* medicinal treatment; but for those that do, we are satisfied there is no remedy so really beneficial and so calculated to save the patient from serious after-effects as quinine. We select the charts of two cases (Figs. 22, 23), on account of their severity, to show the course the cases took when treated with quinine.

Fig. 22 is the chart of a girl, sixteen years of age, who was admitted into King's College Hospital with a very severe form of influenza in January, 1892. She had extensive pleuro-pneumonia of both lungs, with severe pleuritic pain on the left side. She had a brown, dry tongue. She became actively delirious, and her temperature rose to close on 106°. Her highest pulse-rate was 132, respiration 52. The urine contained albumen. Treatment was commenced with salicin in a mixture with sodium bicarbonate and ammonium acetate. Each dose, however, was rejected by vomiting. As the patient's temperature was very high, as she was actively delirious, as her tongue was getting brown and dry, and as both lungs were attacked with pneumonia, we were

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* "La Grippe." Paris, 1898.

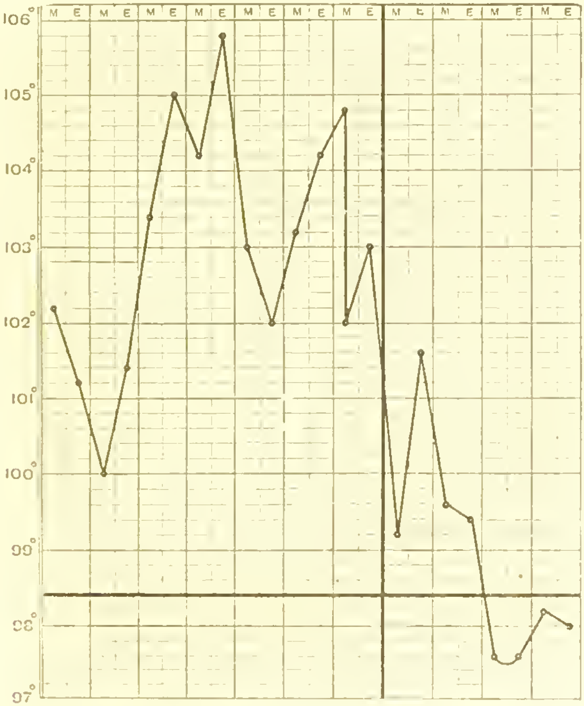

Fig. 22.—Chart of case of Influenza treated with Quinine.

anxious as to the issue of the case. We then ordered her 1 grain of hydrobromate of quinine and 1 grain of phenacetin, every hour, for eight doses, and instructed the house physician to summon us at the end of that time, if he were not satisfied with the effect of the remedy.

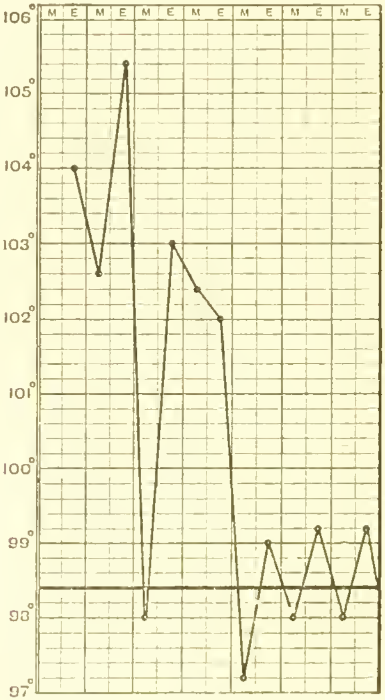

Fig. 23.—Chart of case of Influenza treated with Quinine.

It answered admirably; the temperature fell, the delirium was quieted, and the tongue improved in appearance. She took the quinine and phenacetin hourly for three days, and she made a rapid and complete recovery. She had some ear trouble during convalescence, which was immediately relieved by causing the mixed vapours of iodine and chloroform to pass into the ear from a cupping glass made hot, and into which a few drops of chloroform and tincture of iodine were dropped.

The other case (Fig. 23) was one of a decided gastro-intestinal type so much so that the house physician, having regard to the high temperature, the diarrhœa, and the abdominal pain, and the fact that cases of influenza were not at the time common, admitted it as a case of typhoid fever.

This patient was a night watchman, aged 27, and was admitted in February, 1893. He had been "out of sorts" for ten or eleven days, had felt chilly and drowsy, and had had pains in the head. For the last four days he had complained of loss of appetite, diarrhœa, and sickness, and had shivered at night. There was a good deal of general tenderness over the abdomen on admission, with slight diarrhœa, and the motions were of a light colour. Highest pulse-rate, 120; respiration, 42. His temperature the day after admission reached 105·4°. He was given the same mixture we are in the habit of prescribing for typhoid fever (*see* pages 688-89)—that is, a mixture containing free chlorine, potassium chlorate, hydrochloric acid, and quinine (2-grain doses) every three hours. The effect was most remarkable. In a few hours the temperature had descended below normal, and in four days he was convalescent, although he was kept in the hospital a fortnight longer by way of precaution.

We have selected these two cases for the purpose of showing how advantageously quinine acts in the severest forms of febrile influenza. In the first case phenacetin in small (1-grain) doses was associated with the quinine, and must be given part of the credit for the quick and good recovery. But we have seen abundant reason for believing that patients treated adequately and early with quinine escape the troublesome after-effects of this disease to a greater extent than can be claimed for any other remedy. Common as cardiac feebleness is as an after-effect of influenza, we administered to an elderly patient, who had long suffered from a weak, dilated heart, the quinine treat ment we have described, through a sharp attack of this disease, and he made a rapid recovery and suffered not the slightest aggravation of his cardiac debility. With regard to the *preventive* influence of quinine, we have been furnished with abundance of facts, from a variety of observers, in support of the belief that in some constitutions, at any rate, it does exert a prophylactic power, but *not in others*; and this is precisely what might be expected when we remember the extreme variations in sensitiveness to the influenzal poison displayed by different individuals.

We place these remarks on the action of quinine foremost in what we have to say of the treatment of influenza, because we are convinced that some practitioners have unwisely allowed themselves to be diverted from the employment of this old and tried remedy for infectious fevers, to the use of newer drugs of far less real value, although remarkable for their rapid pain-relieving and temperature-reducing properties.

We have said there are many cases of influenza that require little **medicinal** treatment—cases with a moderate amount of pain in the head, back, and limbs, often some patches of cutaneous hyperæsthesia, chilliness, and a moderate rise of temperature, some coryza and laryngeal catarrh, and general depression. Rest in bed, warmth, light, fluid but nourishing food, some stimulant, of which good port wine and champagne are the best; home-made lemonade for the feverish thirst, and oranges in abundance, are all many such patients need. A gentle aperient, such as effervescing citrate of magnesia, or sulphate of soda, if the bowels are confined; if there is restlessness, from pain and aching of the limbs, 10 grains of Dover's powder with 15 or 20 grains of salicin, ½ an ounce of acetate of ammonia and an ounce of camphor water, in a draught at bed-time for a night or two, is comforting, soothing, and useful to most persons. We believe that this is all that is needed in slight cases, together with moderate doses of quinine continued for a week or ten days after the feverish attack has passed away; but it is rarely safe to overlook the value of quinine during convalescence, even in the slight cases, especially as a protection from remote after-effects.

But there are certain symptoms that require special consideration. An early and sustained high temperature, especially if associated with a tendency to delirium, points either to the absorption of a large amount of the special toxine, or to a peculiar sensitiveness of the individual to the infective agent, or to both. The **indication** is to eliminate the toxine or to neutralise its effect by an anti-toxine, or to lessen the constitutional sensibility to its influence.

It is remarkable how few experimental observations have been made in this direction. Pfeiffer's *bacillus influenzæ* is generally recognised as the infective agent in this disease, and it is especially present in the catarrhal mucus of the air-passages. It would seem probable also that the specific organism, like that of cholera and diphtheria, gives rise to an "intoxication," not to a "septicæmia"; that its toxine is produced on the surface it attacks, and is subsequently absorbed into the blood.

This being the case, efforts to neutralise and antagonise the activities of the infective agent, in the mouth and air-passages, by means of **antiseptic** vapours, sprays, and lotions, are rational and proper. We have seen cases in which a *secondary* infection, after the cessation of the general attack, has appeared to originate in the mouth, affect the salivary glands, extend to the middle ear, and finally involve the brain, which might probably have been prevented by the early and continued and adequate use of disinfecting inhalations and antiseptic mouth-washes.

These applications, if they are to be adequate, give, we are aware, a great deal of trouble, and in very many cases they may not be needed; but they probably save a life here and there, and they may be very influential in preventing the spread of the disease.

We have already given our reasons for thinking that quinine acts as an anti-toxine in this disease, especially in certain constitutions; and although we really know very little about phenacetin, it would seem, from clinical observation alone, to be a very valuable addition, in small doses, to quinine, in cases with high temperature and delirium.

If the headache or the gastro-intestinal pain is great, one or two (not more) small doses (5 grains) of antipyrin may be given for its relief.

Salicin and the salicylates will relieve the muscular pains and cause diaphoresis; they are useful mainly for this purpose, and they should be replaced by quinine as soon as the pains are relieved.

One of the most troublesome and lingering symptòms, in the slighter attacks, is a hard, distressing laryngo-tracheal cough, with scanty, tenacious expectoration. Ordinary sedative, opiate cough syrups and lozenges often aggravate it, by still further thickening the mucous secretion, but a mixture of apomorphine and morphine has been much used for this cough, and often with success. It may be prescribed as follows:—

℞ Apomorphinæ hydrochloridi	gr. j.
Morphinæ hydrochloridi	gr. j.
Acidi hydrochlorici diluti	ʒss.
Syrupi	ʒiv.
Aquæ	ad ℥iv.

M. f. mist. One or two teaspoonfuls for a dose.

Heroin is also a useful remedy for this cough. A good combination is $\frac{1}{24}$ grain of heroin with $2\frac{1}{2}$ grains of terpine hydrate in a pill at night, and a lozenge containing $\frac{1}{10}$ grain may be taken twice or thrice a day.

Relief for this cough will often be found in inhalations of warm saline sprays and antiseptic vapours. A suitable inhalation may be made of 1 dram of glycerine of carbolic acid, 1 dram of spirits of camphor, 2 drams of tincture of benzoin, and ½ ounce of spirit of chloroform—30 to 60 minims to be inhaled from a jug half full of hot water twice or thrice daily. A dram of menthol dissolved in an ounce of spirits of chloroform may be inhaled in the same manner. Ammonium chloride lozenges also are useful, and, best of all, when the season is suitable, change for a few days to the seaside.

The **bronchitis** and **broncho-pneumonia** which complicate many cases of influenza, especially in the aged and feeble, are, as we have already pointed out, most troublesome to treat, and are often fatal.

The general principles which govern the treatment of these affections, and which we have fully considered in former chapters, apply here also; but in influenza we especially require a remedy which shall *thin* the *tenacious bronchial secretion*, so that the patient shall be enabled to expectorate it and clear his air-passages. With this object, warm, stimulating alkaline drinks should be given freely. Hot milk, with an equal quantity of Apollinaris or *Ems* water ¾ in cupfuls frequently, with two or three teaspoonfuls of whisky or brandy in each, will often answer well as an expectorant. Ammonium chloride with ammonium carbonate—10 grains of the former and 5 grains of the latter—with 5 to 10 grains of sodium bicarbonate, ½ dram of tincture of senega, and 1 ounce of chloroform water, and sometimes a few drops of ipecacuanha wine, will be found also an excellent expectorant, and the addition of a tablespoonful or two of hot water to each dose will often promote its action. Inhalations of hot alkaline sprays, to which a little glycerine of carbolic acid is added, will be found to answer well in children, and may be tried also in adults and old people. Mustard poultices may be applied to relieve the patchy pulmonary congestion that often accompanies influenzal bronchitis, and free friction of the chest with *turpentine* liniment is especially useful, partly, no doubt, on account of the antiseptic vapour given off and inhaled. A liberal allowance of alcoholic stimulant will be needed in most of these cases.

In the fairly vigorous such measures as these will be attended with good results; but in the old and feeble all our efforts will often prove in vain, and their air-passages will become obstructed by mucus they cannot expel.

When gastro-intestinal catarrh is a prominent feature it may be needful, after an initial mercurial aperient, to give a few doses of bismuth and sodium bicarbonate. Vomiting will be checked by small doses of morphine and hydrocyanic acid.

Cases of a **cerebro-spinal** type, with very severe cephalic pain, delirium, and ocular and auditory disturbances, may require bromides and opiates. Aural catarrh and otalgia are best relieved by the vapour of chloroform diffused into the ear from a hot glass or cup, into which 10 to 20 drops of chloroform are poured from time to time. The addition of a few drops of tincture of iodine to the chloroform, and painting behind the ear with iodine, are also useful.

Cases of *neuritis* following influenza, and associated with loss of power in the extremities, especially in the legs, have been found by Raymond to get well under electrical treatment combined with strychnine internally.

The nervous and muscular exhaustion that follows most of the severe, and also many apparently slight attacks, requires prolonged rest, and change to the *seaside* or to *mountain air*, and suitable tonics. Strychnine, coca, arsenate of iron, and valerianate of quinine are among the best and most suitable. A few weeks of absolute rest in bed, or (in summer weather) on a couch in the open air or in a well-ventilated room, is in some cases almost indispensable. Most practitioners have found that a very free allowance of wine, chiefly sound port and champagne, is needed during convalescence from this disease. The **cardiac asthenia** which often appears both during and after influenzal attacks requires careful treatment. We have called attention to some remarkable cases of post-influenzal cardiac asthenia elsewhere.* Such cases require very prolonged rest, as well as the judicious use of the tonics we have just named. We think strychnine the best, and we often combine iron and quinine with it. Arsenic may be given to patients who cannot take quinine well, and the arsenate of strychnine is a convenient form. In some instances we have had to give full doses of digitalis with large doses of iron and quinine. Phosphorus, phosphide of zinc, and the hypophosphites and glycero-phosphates have been found useful. In the serious syncopal forms hypodermic injections of caffeine, of strychnine, and of ether have been needed.

Huchard strongly recommends solutions of camphor in sterilised olive oil in these cases; 10 parts of camphor are dissolved in 100 parts of oil, and 20 minims injected subcutaneously twice or thrice daily.

The *inhalation of antiseptic vapours* has been observed by many to be protective against infection, as well as remedial in the attacks. Eucalyptus oil for this purpose has had many advocates; a saturated solution of camphor in terebene has been spoken well of; a liniment composed of equal parts of oil of eucalyptus and chloroform liniment, rubbed warm over the chest, has been found of much service.

Huchard advises that during an epidemic everyone should gargle or spray the throat, nose, and mouth with weak solutions of perchloride of mercury, *formaline* (1 in 2,000), or carbolic acid (5 in 1,000). He points out that much attention should be paid to the action of the skin, the liver, the bowels, and the kidneys, so that the toxines of influenza may be excreted as rapidly as possible; and in order that few new toxines be introduced in the food he would make the diet mainly vegetarian, with

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* *Clinical Society's Transactions*, vol. xxv., p. 185.

2 pints of milk daily, which acts as a diuretic and lessens urinary and intestinal toxicity. The only drug of any value, he says, is quinine. We share, in the main, his estimate of its value.

Perhaps the most popular remedies for this disease have been potassium bicarbonate, antipyrin, phenacetin, quinine, salicin, sodium salicylate, ammonium salicylate, salicylate of quinine, acetate of ammonia, and the ordinary diaphoretics. Formulæ for these and other suggested remedies will be found at the end of the chapter. Isolation from other members of the family is to be recommended, with the view of checking the spread of the disease, which, according to the judgment of the late Sir George Buchanan, "is, in its epidemic form, an eminently infectious complaint, communicable in the ordinary personal relations of individuals one with another."

Old people should be especially and carefully protected from infection, as serious complications are very apt to occur in the aged. The nasal and bronchial secretions should be disinfected; this may be done by expectorating into a portable vessel containing a little 5 per cent. carbolic solution, and by soaking the pocket-handkerchiefs that have been used in the same solution or in boiling water.

Avoidance of exposure to chill and to inclement weather, during the prevalence of epidemics, is most important, for although the evidence is very strong in favour of the conclusion that influenza is mainly spread by contagion from person to person, there exists also much presumptive evidence in favour of the conclusion that the poison is diffusible into the atmosphere, and that exposure to external cold favours an attack, especially in the aged and feeble.

Malarial Fever, Ague, Intermittent Fever

We term "malarial" fevers those febrile states which arise in persons who are or have been exposed to "malaria" infection. This "*bad air*" or *malaria* was supposed to be an emanation from the soil in certain regions, which were on that account termed *malarious.* The *infection* was thought to be telluric and contained in the soil, and it was held that under certain conditions it became diffused into the stratum of air immediately overlying it, and so, in certain circumstances, human beings who were exposed to this air became infected. It was believed that the infection could be carried by winds and currents of air to some distance from its place of origin, so that at times it spread far beyond its usual limits, and assumed almost the character of an epidemic. It was also, at one time, thought that *malaria* only occurred in wet, marshy districts, and that surface moisture and decaying vegetable matter were essential to its production. These views have been greatly modified of late years.

In intertropical regions malarial fever is exceedingly common, and in some places it is continuously present, and in those countries heat and moisture, and a luxurious vegetation, usually co exist with the presence of malaria. Associated with the belief that the poison was in the soil, it used to be taught that "nothing was so deadly as breaking up the virgin soil in the tropics," and that excavation or any other disturbance of the soil of places that are or had been malarious was almost certain to be attended with an outbreak of malarial disease, often of a grave form.

It is unnecessary here to enlarge on the wide geographical distribution of malaria, or to describe the regions that are known to be malarious—they abound in some of the British possessions in India, in Central Africa, in the Southern States of America, and in some parts of Europe, notoriously in the Roman Campagna and the Pontine Marshes, in Italy. In England it is doubtful if it exists at all, in the present day, unless imported.

Until the remarkable discovery of the part played by the **mosquito** in conveying this disease from the infected to the uninfected, the exciting cause of the disease was regarded, as we have said, as a telluric infection, and the infective agent was thought to be contained in the soil of malarious regions. The organism, first found in the blood of malarial cases by Laveran, and named by Marchiafava and Celli *plasmodium malariæ*, is admitted to be the real agent in the causation of malarious affections. This organism, until the last few years, was only known in the human blood. How it gained access to the human body and how it left it was a mystery. It was suggested that it entered through the respiratory organs most commonly, and occasionally in water used for drinking, but, owing to the admirable experimental researches of Ronald Ross, Manson, and others, it is now known to be conveyed from man to man by the bite of the mosquito. The malarial parasite belongs to the group of *Hæmatozoa*, and occupies and destroys the red blood-corpuscles. This organism appears to assume different phases of growth in the different varieties of malarial fever. There is an *amœboid* form which displays active movements within the red corpuscles, and undergoes a process of *segmentation* corresponding to the ague paroxysms. The *larger* forms are found associated with the typical intermittents. The remittent and pernicious forms are associated with a "small plasmodium."

"The general symptoms and morbid anatomy of malaria are in harmony with the changes which this parasite induces. The destruction of the red blood-corpuscles by it can be traced in all stages. The presence of the pigment in the blood and the viscera, so characteristic of malaria, results from the transformation of the hæmoglobin by the plasmodia. The anæmia is a direct consequence of the widespread destruction of the corpuscles by the parasites." Moreover, the parasites disappear, together with the symptoms, on the administration of quinine.

As suitable prophylactic measures depend on a due apprehension of the part played by mosquitoes in conveying the disease, we must briefly refer to the main facts which have been established in this direction.

We are indebted to R. Ross for the discovery that the parasites of malaria "pass a hitherto undiscovered stage of their existence in mosquitoes, and are then inoculated into our skin by the bites of the insect."* "When a mosquito bites a malaria patient it sucks up a number of malaria parasites with the patient's blood. The parasites burrow into the insect's tissues, grow rapidly, and after a week or two produce a number of spores." These spores enter the poison gland of the insect, whence they are injected under the skin through its proboscis when it bites. The malaria spores thus injected mix with the blood of the person bitten and infect him.

It has been recently discovered that *yellow fever* is communicated in the same way, but by another species. It has been found that only in mosquitoes of the kind termed *anopheles* does the development of the parasites of human malaria occur. So far anopheles have always been found where *fresh* cases of malaria are occurring, and the malaria germs have been found in a large percentage of anopheles caught in infected houses; and occasionally in those caught in the bush, which are assumed to have become infected by having previously bitten villagers dwelling near.

Persons in London have been infected by mosquitoes brought from Italy—while others have been kept immune from fever in mosquito-proof houses in the most deadly part of the Campagna. Malarial fever has been diminished in many localities by draining the breeding-places of the anopheles.

It therefore seems now within the bounds of possibility that this widespread disease may be greatly restricted if not altogether prevented.

With regard to the objections that have been made to these conclusions, Ross points out that although it is true that malaria is connected with *stagnant* water, no one has ever found the germ of malarial fever in water or the soil; moreover, it is contrary to all we know of the habits of animal parasites that the malarial germs should diffuse themselves in the air. Another frequently observed fact is also opposed to the old ideas, and that is that of two houses, only a few yards apart, or of even two sides of a barracks or hospital, one may be malarious and the other not so. Again, *wire gauze screens* to the windows, through which the air can enter freely, have proved sufficient to keep out the infecting agent. The true connection between *stagnant* water and malaria is that anopheles breed chiefly in *stagnant puddles* of water on the ground, on the *surface* of which the larvæ are found.

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* Ronald Ross: "Malarial Fever: Its Causes, Prevention, and Treatment."

The old name, ague, would seem, as Ross suggests, to be a better one than malaria (bad air), as it has been shown that this disease is not due to the latter.

The fact that *relapses*, at long intervals, occur without re-infection by mosquito-bites is explained by the consideration that it is only the *first* infection that is caused by mosquitoes: relapses are due to the latent lingering of germs in the body.

It has also been objected that, in some persons, even the first attack was not preceded by mosquito bites. This was probably due to the circumstance that these persons were not sensitive to mosquito bites, and *never noticed them* when they occurred.

To the objection that malaria occurs in places which *seem* to be free from mosquitoes, Ross replies that the *anopheles* are not *en évidence*, as some of the other kinds of mosquitoes are, and that they often visit a house *only after dark*, and make but little humming noise. It must also be borne in mind that as the incubation stage lasts at least three days, and usually much longer, the onset of this fever, in the case of travellers, may occur at a place some distance from the source of infection.

Relapses often seem traceable to fatigue, to exposure to cold, or to bad food.

In connection with prophylaxis it is important to know that the larvæ of mosquitoes and gnats live *only in water*—"tubs, pots, puddles, ponds, and small streams!"—complete *drying* kills them. But the larvæ cannot breathe under water like fishes. They rest hanging head downwards on the surface of the water, the air being drawn in through an orifice near the tail.

The larvæ may be killed by brushing them out of the puddles containing them with a broom—the ground absorbs the water and the larvæ perish. When they are found in water which cannot be so treated, *pouring a little thin oil* on the surface of the water, so as to form a fine film over the surface, kills them by *preventing their breathing*. "For drinking-water eucalyptus oil is good, because after killing the larvæ it evaporates and leaves no taste in the water."

Another plan is to get rid of all collections, small or large, of stagnant water, in the neighbourhood of habitations, so that there may be no place to harbour larvæ.*

The best disinfectant against mosquitoes in an apartment is *sulphur dioxide*. It has been proved to be far more effectual than formaldehyde. Very dilute atmospheres of sulphur dioxide gas quickly kill these insects. It has remarkable powers of penetrating through clothing and fabrics, killing mosquitoes, even when hidden under several layers of towelling, in an hour.

Wire-gauze screens to the windows and the use of mosquito curtains greatly diminish the risk of infection.

There are four principal clinical forms of malarial affections: (1) the *typical intermittent* fever or

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* For further information on this interesting subject, *see* Ronald Ross's "Malarial Fever: Its Causes, Prevention, and Treatment."

ague; (2) the *remittent* or *atypical* form; (3) the *pernicious* form; and (4) the *malarial cachexia*. A very brief account of these different-forms must suffice for our present purpose.

(1) The typical intermittent form is that which we most frequently meet with in Great Britain. Its characteristic features are well known. First, a *cold stage*, generally ushered in by headache, lassitude, nausea, and vomiting. Although in the axilla or rectum the thermometer shows a rise of temperature which may reach 105° to 106°, the surface of the body is cold, and the patient looks pale and cold, and shivers, and his teeth chatter. This stage lasts from a quarter of an hour to an hour or longer, and is gradually succeeded by (secondly) the *hot stage*, when the surface becomes very hot and red, the face flushed, and the pulse, which had been small, hard, and quick, becomes full and bounding, and the head throbs and aches. The temperature remains high, and there is intense thirst. This stage lasts three or four hours, and is followed by (thirdly) the *sweating stage*. A copious perspiration breaks out over the whole body, and this is attended with great relief; the headache disappears, the temperature falls rapidly, the paroxysm passes off, and the patient usually falls into a refreshing sleep. The whole paroxysm generally lasts from twelve to fifteen hours, but it may vary considerably, and the cold stage is sometimes absent. The spleen is usually found to be enlarged during the paroxysms. During the intervals between them the patient feels well. The great characteristic of this disease is the regularity with which the paroxysms return—their periodicity. If the paroxysm returns at the end of twenty-four hours, the type is *quotidian*; if at the end of forty-eight hours, it is *tertian*; if at the end of seventy-two hours, it is *quartan*—this last is a rare form. Golgi has observed that in the tertian type the blood-corpuscles contain small amœboid bodies which develop gradually, become deeply pigmented, and (just prior to and during the chill)

undergo *segmentation* into fifteen to twenty separate bodies, aggregated around the central mass of pigment.

If left untreated, this disease may disappear after a time spontaneously; but it is then liable to recur, and persistence of the fever leads to anæmia and hæmatogenous jaundice from destruction of the red corpuscles by the parasites.

(2) The *remittent* malarial fever is especially seen in tropical countries; it is sometimes termed *bilious remittent* fever and, in India, *jungle* fever. In this form there are no complete intermissions, but only *remissions*, or intervals in which the fever is more or less subdued. The cold stage is less marked, and the third or sweating stage may be absent. The remissions may last twelve hours or longer. The temperature remains constantly above normal, but falls two or three degrees during the remissions, and paroxysms with or without chills may occur, in which the temperature may rise to 105° or 106°. Some cases have a great resemblance to typhoid, and the best diagnostic distinction is to be derived from an examination of the blood for the *plasmodium malariæ*. Vomiting, with epigastric uneasiness, is a marked symptom. Jaundice is not uncommon, and severe headache is usually constant, and occasionally delirium occurs. This form varies greatly in its course and severity.

(3) The *pernicious* form. This is usually rapidly fatal. A *comatose* form has been described in which either acute delirium or coma develops rapidly, with high fever and hot and dry skin; also an *asthenic* or *algid* form, in which there is intense prostration, with subnormal temperature, vomiting, suppression of urine, and frequently death from profound asthenia; and a *hæmorrhagic* form is known and is often spoken of as *malarial hæmoglobinuria* ("black water"), in which the blood destruction is rapid and the urine contains both hæmoglobin and blood-corpuscles. These cases are apt to prove rapidly

fatal. The pernicious forms are often seen in the tropics; and some Italian physicians describe them as of frequent occurrence during severe malarial outbreaks in Italy.

(4) *Malarial cachexia* is generally the result of repeated attacks of ague, although it is said to occur also in persons who have lived long in a malarious region without having actually suffered from fever. It is characterised by great *anæmia*, an *enlarged spleen*, and an irregular subfebrile state, the temperature varying between 99° and 103° F. The symptoms are those due to the profound anæmia and the fever.

We have taken this brief but general survey of the ground covered by malarial infection, in order that we may enter more profitably upon the consideration of its **treatment.**

Quinine is undoubtedly *the* remedy for malaria—it destroys the parasite in the blood—but it has been stated that the parasites vary greatly, according to their various stages of development, in their resistance to quinine, that the phase in which they are most sensitive is the amœboid one, which occurs *between the paroxysms*, and that quinine should be given in this period. Ross, however, maintains that this view is not sound, that the drug should be given as early as possible, "whether the patient has high fever or not."

Manson thinks it best in "simple intermittents" to give the quinine at the commencement of the sweating stage, but in the "bilious" remittent and other grave forms to give it at once and not wait for the remissions.

Quinine does not render the blood immune from further infection; it only acts as a direct poison to the infective agent when present. Of the various salts of quinine that have been proposed for use in this disease, the *sulphate* justly maintains its wide popularity. The acid *hydrochloride* has the advantage of greater solubility and higher alkaloidal strength (hydrochloride = 81·71 per cent., sulphate 74·31 per cent.), but it is somewhat dearer. The *hydrobromide* has been found valuable for long-continued use, and less irritating to the stomach than the sulphate; it is also well adapted to hypodermic injection.

We have already said that very large doses are not needed in ordinary cases; the main point is to ensure the *absorption* of the drug. Much, we think, therefore depends upon its mode of administration, and we have seen reason for believing that much smaller doses are needed when it is given dissolved in citric acid or lemon-juice and in an effervescent form by mixing it with an alkaline solution and combined with a saline effervescent (*see* vol. i, p. 646). It should also, of course, be given, if practicable, when the stomach is empty. Ten to 15 grains will usually check an ordinary paroxysm of ague. It should be given in 3- to 5-grain doses every two or three hours, until the whole quantity has been taken. Given in these divided doses it is less likely to cause vomiting. Even in the most severe cases it is not necessary to give more than 40 grains in the twenty-four hours. Larger doses are not only unnecessary, they are injurious. Effervescing drinks should be given at the same time, and those made with lemon-juice and potassium or sodium bicarbonate are to be preferred. The giving of quinine in pills should be avoided, as they often escape solution and absorption, and if "tabloids" are used they should be broken up and dissolved in acidulated water.* If there is very great objection to its bitter taste, it may be administered in a cachet mixed with an equal quantity of citric acid, and washed down with a wineglassful of lemonade or warm water. *Euchinin* (quinine ethyl-carbonate) has the advantage of being tasteless, and is therefore useful for children and those who object to the taste of quinine. Some acid drink should be given immediately after the dose to dissolve it in the stomach.

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* Messrs. Burroughs and Wellcome have made for the author tabloids in which the quinine can be taken in an effervescing form, or tabloids of citric acid can be obtained and used for dissolving the quinine.

A tabloid of 5 grains of quinine may be dissolved in water with 10 grains of citric acid and then mixed with a solution of 10 grains of sodium or potassium bicarbonate and taken in effervescence. All these drugs may be obtained in the convenient form of tabloids.

The following is a convenient formula for the administration of quinine:—

℞ Quininæ hydrochloridi acidi	gr. lxxx.
Syrupi limonis	℥jss.
Aquæ chloroformi	ad ℥iv.

Misce, fiat mistura. One to four teaspoonfuls for a dose, in two to four tablespoonfuls of water.

A teaspoonful of this mixture contains $2\frac{1}{2}$ grains of quinine, so that the dose is easily calculated.

Quinine is sometimes given *by the rectum* when there is difficulty in getting it taken by the mouth, or when, on account of obstinate vomiting, it cannot be retained in the stomach. The rectum must be first washed out with tepid water, then 10 to 20 grains of acid hydrochloride of quinine should be dissolved in a little warm water, and mixed with 2 or 3 ounces of thin starch and a few drops of laudanum, and injected with a long tube as high as possible, the patient being in the genu-pectoral position. If care is not taken tenesmus will be provoked and a part of the quinine enema will be rejected.

Hypodermic injection offers a very serviceable method of quickly introducing quinine into the system, and is especially applicable to the *pernicious* forms when the patient may be unconscious and unable to swallow. A certain amount of pain attends the introduction of a solution of quinine in this way, but no other risks are incurred, if strict aseptic conditions be observed. Intramuscular injections are said to cause less pain than superficial subcutaneous ones.

The following formula has been recommended for this purpose:—

℞ Quininæ hydrochloridi acidi	gr. xx.
Aquæ destillatæ	♏xv.

Misce. This fills an ordinary hypodermic syringe, and is a full dose of 20 grains, but much less than this dose is effectual in many cases, given in this manner.

Solutions of the *lactate* and of the *hydrobromide* have also been used for hypodermic injection.

We should probably avoid much of the pain that the above concentrated solution causes by using a syringe that would hold half an ounce, and diluting this solution to that extent with warm sterile normal saline solution, and then injecting very slowly and deeply in two or three situations.

The buttock, the lumbar region, between the scapulæ, or the hypochondriac regions, are all suitable places. The solution used should be sterilised by boiling, we should see that the needles and syringe are completely aseptic, and the surface of the skin must be cleansed in the usual way. Very favourable reports of the hypodermic method have been published. By this method it has been stated that only one-fifth of the amount of quinine (when given by the mouth) is required, and the recovery is quicker and more permanent.

Intravenous injection of quinine has been advocated by Baccelli in pernicious forms when other channels of absorption cannot be relied on. Acid solutions cannot be used for this purpose, so he employs the following:—

℞ Quininæ hydrochloridi	gr. xv.
Sodii chloridi	gr. xij.
Aquæ destillatæ	ʒijss.

This solution is boiled and filtered before using, and when warm is quite clear.

A bandage is applied above the elbow, so as to distend the veins of the fore-arm. A small vein, usually in the middle of the inner side of the fore-arm, is selected, and the needle of the hypodermic syringe is introduced from below upward. The syringe is made to hold 75 minims ($7\frac{1}{2}$ grains of quinine), and it and the needle are of course rendered perfectly aseptic before use. The bandage is removed from the upper arm and the fluid then slowly injected into the vein. The occurrence of a small tumour at the seat of puncture would indicate that the needle had missed the vein. The punctured wound is covered with collodion. The symptoms of quinine intoxication soon appear, but do not last more than fifteen or twenty minutes. Baccelli, with 15-grain doses, had brilliant results even in several cases of the pernicious type.

Ross thinks that *relapses* occur from the patient leaving off the quinine treatment too soon, and recommends that he should take not less than 20 grains of quinine a day for the first fortnight, 15 grains daily for the second fortnight, 10 grains daily for the second month, 5 grains daily for the third month, and 10 grains once a week for the fourth month; no doubt, if the patient is obliged to remain in a malarious district, he had better continue to take small doses of quinine daily. Neurotic persons prone to be made delirious by this drug should be given small doses at short intervals, and these should be stopped as soon as signs of intoxication appear. The hypodermic method, with its far smaller doses, would probably suit these cases best. A full dose of potassium bromide, 40 to 50 grains, may be given should such nervous disturbances become manifest.

The only other cinchona alkaloid that can be, with certainty, substituted for quinine is cinchonidine. Anders has given the sulphate of cinchonidine in doses of 30 to 40 grains daily in protracted cases with very satisfactory results.* In the same class of cases *Warburg's* tincture ($\frac{1}{2}$ an ounce three times a day) has been found of service.

As to the value of *arsenic* as a substitute for quinine some difference of opinion exists. Tomassi-Crudeli thinks it of great service as a prophylactic to persons who have to live in malarial districts; others have not found it so. It does not destroy the parasite and is therefore of no use in the acute period.

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* Hare's "System of Practical Therapeutics" (2nd edition), vol. ii., p. 92.

It is, however, a most valuable tonic combined with iron in the anæmia which follows the fever.

Professor A. Gautier has advocated the use of a new preparation of arsenic—*methylarsenate disodique*—as a specific for malarial fever. It is given hypodermically in doses of 5 to 10 centigrammes. It is reported to have been found efficacious in Algiers in certain cases that had resisted treatment by quinine.

Methylene blue has been given by many Continental observers in cases of malarial fever, and it seems to have a decided curative influence over this disease and checks the development of the *plasmodium*; but the general opinion at present is that it is inferior to quinine in efficacy. The dose given has varied from 1½ to 7 grains thrice daily. Care must be taken to obtain the drug *pure*.

Phenocoll has been used in ague by V. Cervello and other Italian physicians, instead of quinine, or when this drug has failed, and favourable reports of its effects have been published. For adults the dose is 20 to 30 grains daily.

But the treatment of malarial fever is not limited to the administration of quinine. In an ordinary attack of ague, at the first onset of the symptoms, such as pain in the back and limbs, yawning, nausea, vomiting, etc., the patient should go to bed and avoid taking anything into his stomach, either food or drink, as it will only provoke vomiting. During the chill he should be warmly covered, and hot-water bottles applied to the feet and back. Attempts to stop the chill by amyl nitrite, or to abort the attacks by pilocarpine, seem to be of doubtful utility. Some give a full dose of morphine to abort the chill if the case is seen early. No doubt this is an expedient which greatly lessens the patient's sufferings. Tepid water may be given to render the vomiting easier and to wash out the stomach, if this symptom is troublesome; if it persists, some effervescing alkaline drink should be given and a mustard plaster applied to the epigastrium; and if very severe, a small dose of morphine may be introduced hypodermically. Symptoms of collapse in the cold stage, which may appear in old or feeble and cachectic persons, must be encountered with ether and ammonia mixture and hot coffee with a little brandy.

In the hot stage lighter coverings may be substituted, and the thirst relieved by fragments of ice, or by sipping iced lemonade, and the surface may be sponged over with tepid water to which a little eau-de-Cologne has been added. Cold applications to the head will relieve the throbbing headache. Small doses of morphine ($\frac{1}{12}$ to $\frac{1}{24}$ grain), with acetate of ammonia, every four hours have been found to relieve the unpleasant symptoms of the hot stage. Antipyrin or phenacetin has been given to relieve the headache, but the depressing action of the former drug has often proved injurious. Large mustard plasters are of great use to mitigate epigastric pain and the congestion of the liver and spleen. During the sweating stage the patient may be allowed to drink freely of water or cold tea or effervescing drinks, as lemonade, etc., and the surface of the body may be rubbed with warm cloths. At this stage, if not before, the specific quinine treatment should be begun in the manner we have indicated. As soon as the temperature has fallen to normal the patient may be permitted to get up and dress and go about.

It is not always necessary, but it is often advisable, to give a purgative when the quinine treatment is begun. In tropical countries this is almost always the rule, and when there exists constipation, with a coated tongue and muddy skin, it is always advantageous. Calomel is usually the best purgative in these cases, and 2 or 3 grains combined with 5 or 6 grains of colocynth and henbane pill, and followed by a seidlitz powder or a dose of Carlsbad salts, will act, as a rule, very efficiently. Some combine calomel with quinine when it seems desirable speedily to get the action of both. Purgatives must not, however, be given as a mere matter of routine, as they may be injurious to the debilitated and to those suffering from chronic intestinal catarrh.*

The appropriate **after-treatment** of these cases consists in giving blood restoratives and tonics, and a generous diet, with a moderate amount of stimulants, such as sound wine or beer. Cold or tepid baths, with frictions and exercise in the best air that is attainable, should be also advised. Small or moderate tonic doses of quinine, with mineral acids, should be given daily during convalescence; and in very anæmic cases a pill of arsenate of iron ($\frac{1}{8}$ to $\frac{1}{4}$ grain) should also be taken three times a day after meals. The bowels should at the same time be kept open by gentle aperients. We should be on our guard against relapses, and on any rise of temperature should return at once to *full* quinine treatment.

In the **remittent** form the treatment should be conducted on precisely the same principles as in the typical intermittent form. As vomiting and gastric irritability are almost always present in these forms, it may be best to give the quinine hypodermically. It is especially in these cases that comparatively small doses of quinine (2 to 3 grains) dissolved in citric acid and given every two or three hours in combination with an effervescing saline, as we have repeatedly advocated in this work, answer so well, and will often be retained even when the stomach has manifested great irritability to other medicines. Constipation, if it exists, must be overcome. Repeated small doses of calomel and ipecacuanha have been recommended for this purpose. To avoid delay and ensure an action of the bowels, enemata of soap and water containing a spoonful or two of castor oil should be given when necessary.

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* Tomassi-Crudeli ("Climate of Rome and Roman Malaria," p. 158) calls attention to a popular remedy which he and other Italian physicians think well of. It is a decoction of the whole lemon fruit. A lemon is cut into thin slices with the whole of the rind and seeds, and is boiled in three glassfuls of water until reduced to one glassful; this is strained, and the remains of the boiled lemon pressed forcibly. It is given to the patient in the morning.

To relieve the headache, delirium, and other nervous symptoms the administration of morphine with atropine has been advised; but there is this great drawback to the use of morphine, that it tends further to embarrass the action of the liver, and it favours constipation. We should prefer to give full doses of bromide by the rectum, with chloral if needful. If we find large doses of quinine are absolutely required we must give them hypodermically—10 to 15 grains every hour or two—and their effect must be maintained by continuing to give 20 to 40 grains daily. The disease, as a rule, will soon yield to this method of treatment. The patient's strength must be maintained by suitable food and stimulants, and we shall often for this purpose be obliged to have recourse to rectal feeding.

In the **pernicious** form quinine must at once be given in *large* doses, as already described, either hypodermically or by intravenous injection. We must make efforts to keep up the patient's strength by rectal injections of beef-tea and brandy, peptonised milk, tea, coffee, etc. Frequent hypodermic injections of strychnine may be needed ($\frac{1}{30}$ to $\frac{1}{20}$ grain every hour or two). Morphine with atropine must be given to allay restlessness. Ether, camphorated oil, and caffeine may also be used, as cardiac stimulants, hypodermically. If there has been *hæmatinuria* during the attack, on recovery, in addition to quinine, perchloride of iron with arsenic will be needed for the relief of the extreme anæmia which is likely to follow. The addition of strychnine has been strongly advocated by American physicians.

Malarial hæmoglobinuria or *blackwater fever* often resists the action of quinine, and R. Koch and others, who have carefully studied cases of this type, maintain that quinine causes the hæmoglobinuria by exercising a destructive action on the blood corpuscles, which are already damaged by the preceding diseased condition of the blood—the malaria! If, then, while giving quinine this symptom appears, the drug should be stopped; the patient should be put to bed, and a dose of calomel, followed by a saline purgative, given. For the vomiting, a mustard plaster to the epigastrium is valuable; and no food should be given by the mouth, but the patient should be fed by nutrient enemata. Some authorities,* while admitting that quinine causes hæmoglobinuria, maintain, at the same time, that the inadequate use of quinine in the treatment of persistent mild forms of fever favours the onset of blackwater fever, and that such persons should submit to a stringent quinine prophylaxis—10 to 15 grains every ninth and tenth days.

Very successful results are reported to have followed the use of a mixture containing in each dose ½ a dram of liquor hydrargyri perchloridi and 10 grains of sodium bicarbonate; this is given every three hours for four days. It is found to control the vomiting and to increase the flow of urine, and it is suggested that "the alkali neutralises the acidity of the stomach and urine and stimulates the renal epithelium, the mercury probably acting as a gastro-intestinal disinfectant."† The pyrexia, if severe, is treated by cold sponging and a few 5-grain doses of phenacetin.

Malarial cachexia, characterised by profound anæmia, an enlarged spleen and liver, and attended with symptoms of gastro-intestinal catarrh and hepatic congestion, and a variety of other symptoms dependent on the anæmia, needs to be treated on general principles. Iron, arsenic, strychnine, nitro-hydrochloric acid, bismuth, ammonium chloride, nitrate of silver, ipecacuanha, podophyllin, calomel, bichloride of mercury, and many other drugs, have been advocated for this condition, and all or any of them may prove suitable to individual cases. But change of climate, dietetic cures, and mineral-water cures are, perhaps, more successful than any other treatment for these patients. Hydrotherapy and massage have been found very useful in the treatment of the local congestions common to this state. Bracing seaside resorts and sub-alpine mountain resorts, among attractive scenery and with scope for pleasant excursions, where blood regeneration can be favoured by a life spent much in the open air, are best suited to cachectic cases.

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* Dr. Stephens: Allbutt's "System of Medicine," vol. ii., part ii., p. 300. London, 1907.

† "Observations on fifteen cases of Hæmoglobinuric Fever in British Central Africa," by Dr. Hearsey, *Brit. Med. Journal*, Jan. 26th, 1901 The perchloride would be decomposed in Dr. Hearsey's mixture!

For the gastro-intestinal and hepatie troubles the following spas are suitable, the selection depending on the nature of the individual case and constitution, viz. Vichy, Homburg, Kissingen, Carlsbad, Marienbad, Brides, Tarasp, Pyrmont, and others.

Prophylactic measures have already been alluded to ; they consist in (a) attacking mosquitoes in their breeding grounds, (b) the careful use of mosquito nets,* and (c) the regular use of quinine, about 3 to 5 grains daily. Those who cannot tolerate quinine should not be sent to malarious districts.

TETANUS

Tetanus is an acute infectious disease caused by the *bacillus tetani* which was discovered by Nicolaier in 1884, and Rosenbach found it in man in 1886. The fact that the symptoms of this disease were prone to make their appearance after the reception of wounds or injuries, or even *slight abrasions of the skin*, occurring in a variety of circumstances, was suggestive of the belief that it was caused by the entrance into the body of some infective agent from without. It is now known to be an infective disease due to the action of a micro-organism which develops at the site of the wound, and there, like the *bacillus diphtheriæ*, produces *toxines* which poison the spinal cord and cause intense exaggeration of its reflex excitability. It does not invade the blood and the organs. Instances have been reported to occur from exposure to cold, or from sleeping on damp ground. In such cases it may be concluded that the specific microbe gains an entrance to the body through some slight unnoticed abrasion of the surface, or of the mucous membranes continuous therewith. Its observed endemic occurrence, under certain circumstances, was also highly suggestive of an infectious origin.

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* For details, *see* Ross's "Malarial Fever: Its Causes, Prevention, and Treatment."

The specific bacillus has been isolated and cultivated. It is a slender rod with a rounded end ("drumstick-shaped"), and may grow into long threads. It is *anaërobic ;* the products of its culture injected into animals excite symptoms of tetanus. Brieger was able to separate from sterilised cultures two toxines which he termed "tetanin" and "tetano-toxin," either of them capable of producing the disease. Tetanus, then, is an *intoxication.* The symptoms caused by this toxine develop slowly, and this fact has given rise to the suggestion that it acts only after it has undergone some further changes in the organism. The natural home of this bacillus is the soil, garden soil especially. The disease has been excited by inoculating animals with garden earth.

It has also been found in putrefying fluids, in manure, and in dust and rubbish. The *anaërobic* nature of the bacillus explains the tendency of tetanus to follow punctures and contusions.

The antiseptic treatment of wounds, on the battlefield, has been found to protect largely from subsequent attacks of tetanus. A form attacking new-born children and parturient women—the poison gaining entrance in these instances, doubtless, through the umbilicus in the one case, and the generative passages in the other—has often been very prevalent in hot countries, especially amongst the negroes of the West Indian Islands. In these cases there can be little doubt that the strict application of antiseptic principles, in dealing with parturient women and new-born children, will prove preventive of the disease. Indeed, it is said that this form of the disease has disappeared since midwives have been taught to dress the navel with iodoform.

We have not space to enter into a detailed description of the symptoms of this disease, which usually appear after an incubation period of one or two weeks from the date of the injury. The most characteristic are tonic spasms of the muscles, usually beginning in those of the face and neck. Sustained spasmodic contraction of the muscles of the jaws leads to trismus or *locked jaw.* The drawing down of the angles of the mouth causes a characteristic grin known as *risus sardonicus.* The spasms extend to the other muscles of the body, especially those of the back ; the patient is thrown into a state of opisthotonos, the back is arched, and the body rests on the head and heels. Various other forms of spasmodic contraction occur. The convulsions are more or less paroxysmal, the slightest irritation is sufficient to bring on the paroxysms, and the more violent ones are attended with agonising pain. The temperature may remain normal, but it is often raised, and in some instances very high temperatures have been recorded, 105° to 106° F., and even 109° to 110° F. just before death. Profuse perspirations are common. There is constipation and not unfrequently retention or suppression of urine. Cases in which the symptoms are late in coming on often recover ; those in which they follow quickly after infection are generally fatal, death occurring in a few days. Probably the shorter the incubation the larger the amount or the greater the virulence of the toxine developed in the wound.

With regard to **treatment**, there can be no doubt that the thorough application of aseptic methods in the dressing of wounds, however trivial, and in the performance of operations, is an important preventive measure. It has been justly remarked that "perfect asepsis in surgical procedures means freedom from tetanus as surely as it means freedom from septicæmia." If tetanus actually exists and a wound is found, free excision and antiseptic treatment of the wound must be carried out.

Owing to the extreme excitability of the nervous system, the patient should be isolated in a darkened room and kept absolutely quiet. Concentrated fluid food and stimulants must be freely given. When, owing to spasm, there is difficulty in giving food, a stomach-tube, attached to a funnel, must be passed along the floor of the nose, through the pharynx into the stomach, and the patient fed in that way. It may be necessary to give chloroform twice or thrice daily to permit of this being done. Sometimes it has been found needful to extract a tooth to allow a feeding tube to be passed into the stomach through the mouth. Brandy or whisky, from 4 to 12 ounces daily, should be given; it acts as a sedative to the nervous system and promotes muscular relaxation. The bowels may be relieved by enemata once daily, and the possibility of the occurrence of retention of urine must be borne in mind. Of drugs, the most efficient is a combination of chloral and potassium bromide in large doses. Chloral has been given hypodermically, and by intravenous injection, with success in some very severe cases. These drugs may also be given by the nose tube or *per rectum.* Thirty grains of potassium or sodium bromide, with 20 grains of chloral, may be given every two or three hours. Chloral may act curatively by its antiseptic as well as by its sedative properties. Inhalations of chloroform prove of great service in allaying the paroxysms, and when these are attended with great suffering it may be necessary to keep the patient almost continuously under its influence. The injection of atropine into the tetanised muscles has proved a useful adjunct to the chloral and bromide treatment. Inhalations of *nitrite of amyl* and hypodermic injections of nitro-glycerine have also been found of service. *Opium* and *morphine* are of undoubted value in this disease. They should be given freely, and are usually well borne. A plan of injecting morphine deeply into the affected muscles has been of great service, and under this treatment the masseters have relaxed and food has been taken.

Many other drugs have been used in the treatment of tetanus, and curative virtues have been claimed for them, such as aconite, cocaine, curare, cannabis indica, tobacco, hyoscyamin, etc.

Carbolic acid has been injected subcutaneously by Baccelli and others in cases of tetanus, and with good results. Successful results have been published; in these cases generally very large doses have been given—in one case as much as 99 grains of carbolic acid in the first twenty-four hours. It is usually injected in 2 per cent. solutions.

Much difference of opinion appears to exist as to the value of *serum* treatment of tetanus in man. As to the *prophylactic* use of tetanus antitoxine there is more general agreement. Its *curative* influence is probably limited by certain conditions which, when known, will account for the discrepancies in the views of those who have applied it.

It is important to realise, in the first place, the course which the toxine follows in its invasion of the nervous system. It appears that during the period of incubation the toxine spreads slowly, not as might be thought, along the lymphatics and blood vessels, but along the axis cylinders of motor nerves, and it is by these channels that it reaches the cells of the spinal cord, the more rapidly the shorter the path it has to traverse and the more virulent the poison. From the spinal cord it passes to the basal centres and to the nerve cells which *control* reflex action and the activity of voluntary muscles. It is important to know that the tetanus toxine has a specific selective action on nerve tissue, with which it forms a more or less stable combination. It is therefore obvious that under such circumstances the antitoxine can exert but little power in suppressing the effects caused by the poison already acting on the nervous system. It is, however, permissible to expect that the antitoxine may prevail in neutralising any toxine that may be *free* in the nerve substance, in its sheath, or in the lymph spaces.

And we may also hope that by such prophylactic injections we may be able to prevent the combination between toxines and nerve cells. We must be convinced also from these facts that we ought to select for our injections of antitoxines those situations where the toxines will most readily be met with; we are therefore advised to make our injections along the motor nerves of the limbs or into the *arachnoid* sheaths of the spinal cord, and *no longer rely upon subcutaneous injections.* No particular advantage appears to have followed injections into cerebral substance.

The chief conditions which may be regarded as determining the success or failure of this mode of treatment are the following:—

1. The dose of the toxine received by the patient. This dose may be overwhelmingly large and cure may be on that account impossible, or it may be small or moderate and the remedy may have, on that account, far better chance.

2. The dose and the activity of the antitoxine. The dose must be large enough to be efficient and the serum must be of known activity.

3. The time which has elapsed between the introduction into the wound of the bacillus and the injection of the antitoxine.

If the serum is applied, as a *prophylactic* measure, immediately or almost immediately after the wound has been received, the best effects may be anticipated, but if the serum treatment is not commenced till some time after characteristic symptoms have appeared, we must not look for success. In cases in which the period of incubation has been short the results of treatment of every kind are unsatisfactory, doubtless on account of the amount or the virulence of the toxine.

It may be taken as a sound practical rule that in all cases of wounds or accidents which from their character suggest the possibility of the supervention of tetanus, protective or minimising doses of anti-toxic serum should be administered. But when once the symptoms of the disease are manifest, serum treatment has not proved very satisfactory, although numerous instances of cure have been recorded.

It must be remembered that this serum causes no very serious noxious effects, even if the injury for which we apply it is not likely to be followed by tetanus. Urticarial rashes are a common sequence, and occasionally painful joint affections, with effusion, have been noted.

Next, with regard to dosage—this must depend somewhat on the age of the patient, the severity of the attack, and the reaction observed to follow the injection. Some recommend that we should at once inject 100 c.c., and repeat this dose on the two following days and give a final injection 10 to 13 days after the first injection—making 400 c.c. in all. Others prefer small doses—10 c.c. frequently repeated. They regard them as more satisfactory than single large injections. It has been recommended that the serum should be injected at the site of the entry of the virus when that is known. We have already mentioned that, according to the latest views of the mode of invasion of the nervous system by the poison, it is better to make the injections along the nerves or into the spinal theca and not to be satisfied with subcutaneous injections. The serum is costly. At the Lister Institute 3 phials, each containing 10 c.c., cost 12s. 3d., so that the 400 c.c. regarded as the average quantity needed in an ordinary case would cost about £8. That supplied by Burroughs and Wellcome, or by Parke, Davis and Co., is rather less costly. Great care must be taken, in making the injections, to avoid sepsis.

As examples of dosage in three cases of recovery the following may be cited :—

(1) An adult seen eight days after the accident received 83 injections in all. August 1st, 10 c.c. ; 2nd, 20 c.c. ; 3rd, 20 c.c. ; from 3rd to 20th, 20 c.c. every twelve hours ; 20th and 21st, 10 c.c. every twelve hours ; 21st to 26th, 10 c.c. daily ; 28th, 10 c.c. The reporter thought it would have been better to begin with 20 c.c All the injections were given subcutaneously.

(2) An adult—treatment begun five days after injury. Only 110 c.c. in all were needed, given on the 1st, 5th, 9th, 11th, and 12th, also subcutaneously.

(3) A child eight years of age—August 21st, 60 c.c. ; 22nd, 30 c.c. ; 23rd, 30 c.c. ; twelve doses of 10 c.c. in three days.* In all the cases reported, sedatives, such as chloral and bromide, chloroform by inhalation, and morphine, were also given freely.

ADDITIONAL FORMULÆ.

For influenza—febrile form

℞ Quininæ sulphatis } āā ʒss.
Extracti cinchonæ }
Extracti aconiti radicis, gr. jss.

M. et divide in pil. xx. One three times a day. (*Huchard.*)

For influenza with pulmonary catarrh and inflammation

℞ Pulveris ipecacuanhæ compositæ, ʒss.
Pulveris scillæ, ʒss.
Quininæ sulphatis, ʒss.

M. et divide in pulv. xx. Four to five daily. (*Huchard.*)

For gastric pain and vomiting in influenza

℞ Sodii bicarbonatis }
Magnesiæ calcinatæ } āā gr. v.
Bismuthi salicylatis }

M. f. pulv. Three to five daily. (*Huchard.*)

As a pulmonary antiseptic and for relief of headache and muscular pains

℞ Benzol. pur., ♏lxxx.
Spiritus vini rectificati, ℥j.
Tincturæ chloroformi comp., ʒiij.
Mucilag. tragac. ad ℥viij.

M. f. mist. A tablespoonful every two or three hours in lemonade. (*Robertson.*)

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* *British Medical Journal*, March 9th, 1907.

Carbolic acid in influenza

℞ Acidi carbolici puri, ♏ij.
Syrupi simplicis, ♏xl.
Tincturæ cardamomi compositæ, ♏x.
Spiritus chloroformi, ♏x.
Aquæ menthæ piperitæ ad ℥j.

M. f. haust. To be given every four hours until the temperature is normal. Give also for sleeplessness at night.

Pulv. ipecac. comp., gr. x.

Syrup for the cough

℞ Liquoris morphinæ hydrochloridi, ʒj.
Acidi hydrobromici diluti, ʒj.
Chloroformi puri, ♏iij.
Tincturæ limonis, ʒj.
Syrupi ad ℥jss.

M. f. syrup. A teaspoonful for the cough. (*Simson.*)

Mixture in influenzal pneumonia

℞ Ammonii carbonatis, ʒiv.
Tincturæ cinchonæ, ℥jss.
Spiritus ammoniæ aromatici, ʒiv.
Decocti cinchonæ ad ℥xij.

M. f. mist. Two tablespoonfuls with a tablespoonful of lemon-juice in effervescence every four hours. (*Whitla.*)

Camphor in influenza

℞ Spiritus camphoræ } āā
Tincturæ lavandulæ } ʒij.
Spiritus chloroformi, ʒj.
Mucilaginis tragacanthæ, ℥ij.
Aquæ ad ℥vj.

M. f. mist. Two tablespoonfuls every four hours. (*Devereux Long.*)

For the pulmonary complications of influenza

℞ Ammonii chloridi, ʒij.
Apomorphinæ hydrochloridi, gr. j.
Misturæ glycyrrhizæ compositæ, ℥jss.
Syrupi, ℥jss.

M. f. mist. A dessertspoonful every two hours. (*H. C. Wood.*)

For the diarrhœa of influenza

℞ Bismuthi subnitratis, gr. x.
Acidi carbolici, gr. jss.

In a capsule. One every two, three, or four hours. (*H. C. Wood.*)

Capsules for influenza

℞ Salol, gr. lx.
Phenacetin, gr. xl.
Quininæ sulphatis, gr. xx.

M. et divide in cap. xx. Two to be taken every three hours. (*E. B. Palmer.*)

For severe neuralgic pains in influenza

℞ Exalgine, gr. lxxv.
Tincturæ aurantii, ♏lxxv. (rub together and add sufficient alcohol to dissolve the exalgine).
Syrupi aurantii, ℥j.
Aquæ destillatæ ad ℥v.

M. f. mist. A tablespoonful for a dose (one or two doses will usually suffice). (*Bardet.*)

To relieve headache, pain, and sleeplessness in influenza

℞ Chloral, gr. xxij.
Syrupi codeiæ,* ℥j.
Infusi tilliæ,* ℥iij.

M. f. mist. A third to be taken at first, followed by a tablespoonful every hour. (*Larmande.*)

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* French Codex.

In pneumonia and post-influenzal asthenia

℞ Tincturæ kolæ } āā ℥j.
Tincturæ cocæ }

M. f. mist. Two or four teaspoonfuls daily in water.
(*Huchard.*)

Diaphoretic in influenza

℞ Pilocarpinæ hydrochl., gr. ss.
Morphinæ sulphatis, gr. ss.
Aquæ, ℥iij.

M. f. mist. A teaspoonful every fifteen minutes.
(*H. C. Wood.*)

As a substitute for quinine in influenza

℞ Strychninæ sulphatis, gr. $\frac{1}{48}$.
Cinchonidinæ salicylatis, gr. ij.

M. f. pil. To be taken every four hours. (*Packard.*)

CHAPTER VI

TREATMENT OF CHOLERA.—TREATMENT OF CEREBRO-SPINAL FEVER

CHOLERA—A Specific Microbic Infection—Mode of Diffusion—Course and Symptoms—(1) *Stage of Invasion*, Gradual or Sudden—Purging—Vomiting—Cramps—(2) *Stage of Collapse*, or "Algid" State—Symptoms of this Stage—(3) *Stage of Reaction*—Cholera Typhoid—Cholerine—The "Comma" Vibrio—Its Mode of Action—Anticholeraic Vaccination—Prophylactic Measures—Indications for Remedial Treatment—Purgatives—Castor Oil—Calomel—Chloroform and Camphor, Turpentine—Caution in the Use of Opium—Intestinal Antiseptics—Salol—Chloroform—Tribromophenol—Bismuth—β-Naphthol—Thymol—Hot Intestinal Injections of Solution of Tannin—Quinine—Intravenous or Subcutaneous Injection of Warm Saline Solutions—Subcutaneous Injections of Camphor and Oil—Hot Baths, etc. etc.—Summary.

CEREBRO-SPINAL FEVER—Causation—A Micro-organism—Anatomical Characters—Great Variability in its Different Forms—Their Symptoms—Complications and Sequelæ—Diagnostic Methods—Lumbar Puncture—*Treatment*—Flexner and Jobling's Serum—Morphine Hypodermically—Wet-Cupping—Ice-bags—Baths—Lumbar Puncture—Perchloride of Mercury—Potassium Iodide—Other Remedies.

CHOLERA

IN order that we may establish **rational indications** for the **treatment** of cholera, we must first inquire briefly into its pathological nature and its characteristic symptoms and manifestations.

It has now been clearly established that cholera is a disease resulting from a *specific microbic infection*: the pathogenic organism, the presence of which stands in causal relationship to this disease, being the *comma bacillus* or *vibrio* of Koch.

The infection is conveyed from infected to non-infected districts by human agency, and the spread of epidemic cholera always follows the accustomed routes of human intercourse and travel. Contaminated water plays the chief *rôle*, directly or indirectly, in its diffusion and spread. At the same time, it is necessary to remark that the infective organism may be conveyed in a more direct manner from the infected to the non-infected. And it does not follow, because water is the agent chiefly concerned in its spread, that it cannot be conveyed in other ways. The fact to be remembered is, that the cholera infection depends on the passage of a specific micro-organism from the interior of one human body into that of another, and that water is the agent usually concerned in the transference. Cholera is a local infection of the intestinal tract with a consequent intoxication.

What are the characteristic course and symptoms of this extremely fatal malady? So far as can be ascertained, the *incubation* period of Asiatic cholera is a brief one. The average is probably about two or three days; in some instances it has appeared to be considerably longer, and in many much shorter—not more than twelve hours. It is usual to recognise three stages in the course of the disease—(1) that of invasion, (2) that of collapse, and (3) that of reaction.

The period of *invasion* may be *gradual* or *sudden*, and this probably depends on the amount or the virulency of the infective agent received into the body in each case, or on the individual sensitiveness and reaction to the pathogenic organism. It should not be overlooked, because it has an important bearing on the success of treatment, that different individuals, and the different composition and state of the contents of their alimentary canal, act as so many different culture media to the pathogenic microbe; and the factors being different in different cases, the results are different. We desire to emphasise this, because the failure of therapeutic resources is constantly spoken of as though they ought to have an *absolute* rather than a *relative* influence on the cure of disease. Nothing could be more irrational. The idea is a survival of the old belief that the *cure of disease* is something supernatural, instead of being as strictly conditioned as every other event in life.

Upon the nature of the *invasion* stage will depend much of the success or non-success of therapeutic intervention. When it is *gradual*, it may last for two or three days, and is then marked by moderate diarrhœa, with colicky pains, a sense of exhaustion and general depression, noises in the head, and a pale and anxious countenance. It is during this period that we may hope to be able to counteract, in an effectual way, the toxic influence of the infective agent.

In other instances the invasion is *sudden*. The patient is struck down suddenly with alarming depression, and generally with violent purging. The contents of the bowels pour out in a copious liquid stream, and rapidly drain the blood of its fluid constituents. The evacuations, at first bile-stained or fæcal, soon become colourless, and have been spoken of as "*rice-water stools*," from their resemblance to water in which rice has been boiled. They contain enormous numbers of comma bacilli and other bacteria. At the same time, *profuse vomiting* of the same kind of fluid usually occurs. Violent and very painful *cramps* may now appear, affecting chiefly the lower extremities and the abdomen; and the patient may pass into the second stage—the "*algid*" state, or state of *collapse*. This may come on within a few hours of the commencement of the purging, and its symptoms have been regarded as dependent, either on the amount of toxic material absorbed from the intestine, or on the enormous drain of fluid from the body, so that there is failure of the circulation, as the thickened blood cannot flow freely, and the pulse becomes feeble, thread-like, or wholly imperceptible. The surface is livid, cold, shrunken, and covered with a clammy sweat; the countenance is shrunken and blue, the eyes are sunk, the nose pinched and pointed, the tongue and the breath cold. The axillary temperature is subnormal—93° to 94°—but the temperature in the rectum and vagina may be found raised, in this stage, from 100° up to 104°. It was noted during the epidemic at Hamburg in 1892 that severe cases had a very low temperature from the first, and that the fatal ones terminated without its rising. The respirations are quickened up to 30 or 40. One of the most distressing symptoms due to loss of fluid from the body is *intense thirst.* There is great muscular feebleness and exhaustion, sometimes accompanied by extreme restlessness, at others by complete mental apathy. There is, however, no loss of consciousness, and the patient may be roused to reply to questions, although the voice is feeble or almost inaudible. The abdomen is retracted, distressing hiccough frequently occurs, and there is often complaint of burning heat in the epigastrium. Another consequence of the drain of water from the blood is *suppression of urine.*

Death may occur rapidly in this collapsed stage—in twelve hours or less—or it may be protracted to the second day; or the patient may pass out of this stage of collapse into the third *stage*, that *of reaction.* After, perhaps, a brief sleep, the circulation improves, the surface becomes warmer, the features are less shrunken, and there is some return of colour; the temperature in the axilla rises a degree or two. Recovery is often extremely and remarkably rapid. In some cases, however, relapses occur during the reactive stage, purging and vomiting return, and death from exhaustion may follow. Sometimes there is only partial reaction, and the pulse remains weak, the surface cold, the bowels relaxed, and there are signs of nervous irritability and exhaustion—drowsiness and depression, or sleeplessness, and even maniacal excitement. The appearance of a roseolous exanthem on the skin is observed in some cases during convalescence. The renal secretion is slowly re-established, and usually contains albumen. It is important to see that it is not retained in the bladder.

There is sometimes encountered a form named "*cholera sicca*," in which there is no purging. This is usually a rapidly fatal form, and the intestines are found, *post-mortem*, filled with the rice-water evacuations. It is probable that in these cases the toxic action on the nervous system is especially virulent, and the intestinal walls are paralysed.

A typhoid state—*cholera typhoid*—sometimes occurs during the reaction period, marked by delirium, a dry tongue, feeble rapid pulse, and slight rise of temperature. This may terminate rapidly in coma, or after some days it may end in recovery. It has been referred to uræmia. It has been observed to occur in about 25 per cent. of all severe cases in the second half of the first week.

The form termed *cholerine*, which is often observed during epidemics of cholera, and which assumes various degrees of severity and is attended with diarrhœa, colic, vomiting, cramps, and occasionally slight collapse, is probably in some cases a kind of abortive cholera, and in others merely an intestinal catarrh contributed to by nervous alarm and errors in diet.

The "**comma vibrio**" is always found in the discharges from the bowels and in the contents of the intestine in this disease; it has the form of a slightly curved rod, thicker than the tubercle bacillus, and about one-half its length. Although several micro-organisms have been found resembling it in shape, its true specific characters are distinctively displayed in cultures in various media. It has not been observed to form spores. It was thought not to be a very resistant organism, and that it perished, more or less quickly, in common water. But recent observations tend to support the view that the cholera vibrio "is able not only to persist a long time in spring and river water, but that, under certain conditions, it can even increase."*

During cholera epidemics virulent organisms are occasionally found in the intestinal discharges of perfectly healthy persons, showing that these persons enjoy an *immunity* from infection by these bacilli; moreover, cholera cultures have been swallowed with impunity.

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* Dr. Dunbar, Director of the Hygienic Institute, Hamburg. The same authority states that he was able to demonstrate cholera vibrios, still capable of developing, in cholera dejecta kept at room temperature or on ice, after 163 days. Osler and McCrae's "System of Medicine," vol. ii., p. 720.

Dr. Dunbar states that during the Hamburg epidemic in 1892-3, he was able, by the help of the peptonic culture mediums, "to recognise the cholera vibrio in no less than 28 persons who were completely healthy and besides had never suffered any symptoms of cholera or the slightest diarrhœa."

As to the production of a *curative serum*, Bulloch observes that, "although the injection of cholera vibrios gives rise in animals to a specific bactericidal serum, such a serum has been found of little effect on the course of cholera in man."

Of *protective inoculation* he says: "Active immunisation against cholera has been practised in India on man, on a large scale, by Haffkine, who used cultures of cholera vibrios in two strengths with *partially* favourable results." Observations are in progress, especially by Kolle and Pfeiffer, to determine whether an effective protection may be obtained by using the products of metabolism of the cholera vibrios themselves.

Cantani's observations of the last epidemic in Naples induced him to regard protective inoculation with mistrust, for he there encountered well-marked second attacks of cholera four to six weeks after the first equally well-marked attack.

Plain and simple as **prophylactic** measures against attacks of this disease are, they are undoubtedly difficult of application to the members of those classes who invariably become its first victims, and who are especially responsible for its spread. The one word "*cleanliness*" comprises nearly all that can be urged by way of prevention; but it is not of much use preaching cleanliness to those classes who have all through their lives been utter strangers to its meaning. "Cleanliness" means additional trouble, additional labour; and filthy habits are bred of indolence rather than of ignorance. It is only panic, and the fear of death, that will rouse these classes, for a time, to the energy that is needed in order to be clean.

The discovery of cholera bacilli in the stools of certain perfectly healthy persons, to which we have already referred, and the fact that convalescents may harbour cholera bacilli in their intestinal tract for many weeks, make it evident that a perfectly healthy person or a convalescent may be the means of conveying the disease from one place to another. So that there may be "*carriers of cholera*" just as there are "*carriers of typhoid.*"

During a visitation of cholera, actual or threatened, it is needful to pay more than usual attention to the observance of the ordinary laws of health. All causes of physical exhaustion, excesses of all kinds, should be avoided. Moderation in food, in exercise, in physical and mental effort, should be observed. Everything that can lower the general tone should be guarded against. Great moderation in the use of alcoholic stimulants should be specially enjoined. All drinking water and all milk must be boiled and kept in carefully closed vessels. The water used for washing the person and all domestic utensils must also be boiled, unless its source is absolutely beyond the possibility of contamination.

All outhouses and receptacles for refuse should be cleansed and freely whitewashed, and the refuse destroyed. No overcrowding of work-, sleeping, or other rooms should be permitted, and adequate ventilation should be enforced. No accumulations of dust should be allowed, and all walls, floors, shelves, etc., should be frequently cleansed of such deposits. It is best to use for this purpose wet cloths wrung out in an antiseptic fluid and plunged after use into boiling water containing some antiseptic. Personal cleanliness in domestics and others should be seen to, and particularly those who have the care of *children*, amongst whom often the disease first appears. Children require the most careful watching, as they are so apt, those of the poorer classes, to consume unclean food and to be dirty in their personal habits. Fruit and vegetables should be eaten with great caution, and only such as are in a perfectly fresh and sound state. All food bordering on decomposition is most dangerous. The agency of **flies** in spreading cholera has been abundantly demonstrated, and great care should therefore be taken that they do not settle on or contaminate any food supplies, and efforts should be made to exclude them from dwelling-houses. Atmospheric conveyance of infection is comparatively rare, as the germs when dried die rapidly. Isolation of infected persons should be strictly carried out, and everything that is used in or comes from the sick-room should be thoroughly disinfected, as has already been pointed out in the preceding chapters on the treatment of infective fevers.* Attacks of diarrhœa or stomach disturbance should receive immediate medical attention, and great caution should be observed in treating such cases. It should be borne in mind that if the attack happens to be a mild or abortive form of cholera, opium internally is likely to do harm, though there is no objection to small doses given hypodermically to relieve pain, and it is in all cases safer and better to give a mild purgative such as Gregory's powder, with some warm carminative such as the aromatic spirits of ammonia and essence of peppermint. If after such a dose an astringent seems necessary, it is best to give an intestinal antiseptic, such as bismuth subnitrate, or salicylate.

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* The following have been found in Germany to be the best and cheapest disinfectants for use on a large scale: (1) Chlorinated lime. (2) *Milk of lime*, made by breaking up 1 part of quicklime in 4 parts of water; the lime is first slaked with a portion of the water, and the rest stirred in; this is kept in a closed vessel, and shaken when used. (3) Carbolic acid. (4) Steam sterilisation and the boiling temperature. (5) For washing purposes, soft (potash) soap, 1 lb. to 17 quarts of water, with 5 per cent. of carbolic acid added; articles are completely immersed in it and boiled for half an hour. The *stools* have been disinfected in the wards with *lysol* or carbolic acid, and afterwards thoroughly mixed with chloride of lime. Lysol is a coal-tar product resembling carbolic acid, but is cheaper; it is used in 1 to 3 per cent. solutions.

The great recommendation of these bismuth compounds, when given in *large* doses and kept suspended by mucilage, is that they form a protective antiseptic coating to the epithelial covering of the intestinal walls, and so present an obstacle to the absorption of toxines from the contents of the intestine.

From a consideration of the nature and pathological characters of this disease the following **indications** for remedial **treatment** may be deduced :—

(1) To destroy or annul the activities of the cholera bacilli in the intestines, and sweep them out of the body. (2) Subsequently to protect the denuded intestine. (3) To eliminate or neutralise the absorbed poison. (4) To replace the lost fluid so as to counteract the thickening of the blood due to this loss. (5) To relieve symptoms, chiefly the *vomiting* and the painful cramps. We must remember that the functions of the liver and kidneys are for the time suspended. This is generally believed to be dependent on the loss of the fluid essential to their functions.

It will be seen from these indications that the *rational* treatment of cholera is mainly **eliminative** and **antiseptic.** When cases of cholera are seen in the first stage, when nature is making an effort to throw off the poison by the bowels, we must aid her by the administration of an unirritating purgative, and if we can at the same time combine with it an intestinal antiseptic, we shall be fulfilling very completely the first indication. A small dose of castor oil is one of the best purgatives for this purpose. Calomel is also valuable, and it is an antiseptic as well as a purgative. Gregory's powder, together with a few grains of calomel, may be prescribed if, owing to vomiting, castor oil cannot be taken.

We would suggest the following emulsion of castor oil :—

℞ Olei ricini	ʒvj.
Chloroformi	♏xx.
Essentiæ menthæ piperitæ	♏xl.
Syrupi et mucilaginis	ad ℥ij.

Misce, fiat mistura. A tablespoonful every 15 minutes until the whole is taken.

If either of the doses is vomited it should be immediately repeated. If for any reason castor oil cannot be taken, we should give calomel—a dose of 5 grains at first, and a grain every hour until about 10 grains have been taken; then we should continue to give it in $\frac{1}{4}$-grain doses every two hours as an antiseptic. We should give at the same time a stimulating and antiseptic mixture of chloroform and camphor; and as gastric absorption is almost abolished, we might expect this mixture to reach and disinfect the small intestine.

The following is a suitable formula:—

℞ Chloroformi	♏lxxx.
Spiritus camphoræ	āā ʒij.
Spiritus ammoniæ aromatici	
Mucilaginis	℥ij.
Aquæ menthæ piperitæ	ad ℥viij.

Misce, fiat mistura. Two tablespoonfuls every hour.

The chloroform and camphor both yield antiseptic and anæsthetic vapours, and we might hope these would have an antitoxic and soothing effect in the small intestine; or capsules of chloroform and camphor might be given.

Liebermeister is a warm advocate of the *calomel* treatment. If treatment is begun *early*, he gives small doses of opium, frequently repeated. Then if the diarrhœa continues he gives 5 to 7 grains of calomel every hour or two "until the appearance of profuse green calomel stools," and then returns to the opium. "Under special circumstances the administration of calomel may require repetition later on." *

Treatment on these lines, in the early stage, has been found to be the most successful in recent epidemics in Germany, Russia, and Italy. One Russian physician began the treatment with 20 grains of calomel and an ounce of castor oil, and he reports that the mild cases recovered quickly, and so did many in the algid state. Another started with a purgative dose of calomel combined with naphthalin, and continued with smaller doses of each. In Hamburg, mild threatening cases were stopped by an initial dose of castor oil, and in more advanced stages calomel in $1\frac{1}{2}$-grain doses or in repeated small doses of $\frac{1}{6}$ to $\frac{1}{8}$ grain was found to answer well. In severe attacks, those of well-marked general intoxication, we are informed, "calomel was the only drug that held its own," although opium in the early stage is still advocated by many Indian authorities.

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* Nothnagel's "Encyclopædia of Practical Medicine" (English translation), art. "Cholera."

In the reports of recent European epidemics there is a general condemnation of the use of *opium* to arrest the diarrhœa of the early stage. Cases so treated did worse than under any other treatment. The early use of opium increases the risk of the absorption of the cholera poison and favours its retention in the body. In Hamburg opium by the mouth, in sedative doses, had a decidedly unfavourable effect, but small doses of an aqueous solution, given subcutaneously, sometimes acted remarkably well. We recognise the usefulness of opium to relieve *pain* and to lessen nervous exhaustion, and we see no reason why one or two small doses of morphine should not be given hypodermically, or a mixture of opium and camphor liniments rubbed in freely over the abdomen. It is doubtless by its soothing and conservative action on the nervous system, rendering it less sensitive to the morbid toxines that have been absorbed, that opium is valuable. It, in this way, lessens the tendency to fatal exhaustion; but small doses only should be given.

An experienced Indian medical officer, now retired, writes to us, "If I were unfortunate enough to catch it (cholera), opium would be the last drug I would take. I have never given it in a single case, but always castor oil."

Other methods have been adopted for neutralising the effects of the bacillus, and its toxic secretions, in the intestine, and with good results. The part to be played by purgatives is obviously a brief one, and, after the toxic contents of the intestine have been swept away, we have to trust to intestinal antisepsis to neutralise any further development of toxines ; and we have to fulfil another indication, and that is "to protect the denuded intestine." If we continue the use of calomel, it should be for its antiseptic action, and repeated small doses of $\frac{1}{6}$ or $\frac{1}{8}$ grain have been found best for this purpose.

Large doses of bismuth subnitrate and salicylate combined, mixed with mucilage and chloroform water, should prove most useful in fulfilling this indication, as :—

℞ Bismuthi subnitratis	āā gr. xxx.
Bismuthi salicylatis	
Mucilaginis	ʒij.
Aquæ chloroformi	ad ℥j.

M. f. haust. To be taken every two or three hours.

Salol, as an intestinal antiseptic, has not maintained the reputation that was somewhat prematurely claimed for it. Those who had the best opportunities of testing its value in the Hamburg epidemic concluded that no confidence could be placed in it. We note that one observer, who wrote in its praise, gave 15 minims of chloroform with 10 grains of salol every two hours, and he does not appear to have realised that the chloroform may have been the more efficacious remedy of the two. We have a great belief in the value of chloroform, if it can be made to reach the intestinal canal ; and Desprez has warmly advocated the use of the following mixture :—

℞ Chloroformi	♏xv.
Alcoholis	ʒij.
Ammonii acetatis	ʒijss.
Syrupi morphinæ hydrochloratis (Fr. Codex)	℥x.
Aquæ	ad ℥v.

Misce, fiat mistura. A tablespoonful every half-hour until the symptoms are relieved.

He also recommends chloroform water as a preventive. In a former epidemic in England we observed apparently preventive properties in chloroform and camphor drops, made by dissolving 3 drams of camphor with 1 dram of chloroform; 4 or 5 drops on a small lump of sugar were taken two or three times a day as a prophylactic.

Tribromophenol (or *bromol*), obtained by the action of bromine on phenol, has been highly praised by Prof. Hueppe as a remedy in cholera. It is not poisonous, and has "almost a specific effect" on comma bacilli. He uses a combination with bismuth—tribromophenol bismuth; this neutralises the poison and protects the intestinal mucous membrane. He gives 75 to 105 grains a day in 7½- to 15-grain doses. He has used it in all stages and forms of severity, and he has been very satisfied with the results. Next to this he considers calomel the best remedy.

A combination of *β-naphthol* and *bismuth* has been given by Nencki to promote intestinal antisepsis, and with good results.

Thymol has been found very fatal to the cholera microbe; and in 1 : 1,000 solution in water is said to kill the bacillus in five minutes; and it has been proposed to inject into the bowel 4 grammes (60 grains) of thymol dissolved in 4,000 grammes (125 oz.) of water. This brings us to the recommendation of Cantani, which has been largely adopted and widely approved—viz. large **intestinal injections of solutions of tannin:** 3 to 4 pints of a 2 per cent. solution of tannin, with or without a few drops (20 to 30) of laudanum, at a temperature of 100° to 104° F. Cantani believes that with these large injections, given slowly, with the buttocks raised, the resistance of the ileo-cæcal valve is overcome, and that the fluid finds its way into the small intestine. The author of this method asserts that, if applied in the early stage, nearly every case recovers; and most of those who had charge of cholera cases in Hamburg write in its praise. Hueppe says it "cleans the large gut, moderates the diarrhœa, and warms up the chilled body," and others testify to its "curative effects" in moderately severe cases. The injections are given after each stool, usually about every three or four hours; they are said by Cantani to increase the acidity of the intestinal contents, to kill the cholera bacilli, and to lessen their toxic effects. Some Russian physicians also wash the stomach out with Cantani's solution of tannin (5 in 1,000) at 104° F. A quart of the solution is slowly injected into the stomach through a hard indiarubber tube, and two quarts are also injected by the rectum. Vomiting is arrested thereby and diarrhœa checked. Alexinsky, who adopted this method, gave also 20 drops every hour of equal parts of Hoffman's anodyne and ethereal tincture of valerian; also calomel $\frac{1}{10}$ grain, opium $\frac{1}{10}$ grain, and bismuth 5 grains, every hour. Attention has been called to the value of *quinine* in cholera by some Russian physicians, and the antitoxic effect of the drug has perhaps scarcely been sufficiently examined in this disease. The hydrochloride has been given subcutaneously in 30 per cent. solutions in boiling distilled water, with the addition of a little chloride of sodium; and after cessation of the vomiting it has been given by the stomach in combination with salicylate of bismuth and opium. Brilliant results from its use are claimed. Professor Botkin used to give quinine both as a preventive and as a remedial agent.

The *third* indication, "to eliminate or neutralise the already absorbed poisons," is one that, with our present knowledge and resources, it is not easy to fulfil. We may, perhaps, best fulfil it by endeavouring to aid the system to eliminate the poison in its own way, by helping it to tide over the serious part of the crisis—*i.e.* the first intense shock and injury due to the absorbed poison. In order to do this, we must give effect to the *fourth* indication, which is "to replace the lost fluid, and so to counteract the thickening of the blood due to its loss" and revive the circulation. Now this can be and was done, especially during the epidemic in Hamburg, in a very effectual manner; and by universal testimony many lives were saved thereby, although the method employed frequently fails to save the more desperate cases.

The method used for this purpose is the *intravenous* or *subcutaneous injection* of large quantities of warm saline solution. These injections cannot repair the injury done by the poison to the heart muscle, or to the vaso-motor nerves, but they dilute the poison and carry off the products of metabolism; they stimulate the heart's action, and the constitution gains time to struggle with the poison, and often with success; they also afford an opportunity of strengthening the patient with food and medicine. The solutions are usually composed of 6·6 per cent. of common salt, dissolved in water, sterilised by boiling, and rendered alkaline by the addition of a little sodium bicarbonate.

If injected into a vein, about 3 to 4 pints are used *warm*—rather less if injected subcutaneously. In either case the transfusion is made by gravitation only.

"The warm solution is placed in a glass jug with a nozzle, to which a wide insoluble tube is attached, and either hung up on a hook in the wall or placed on a special stand, a fall of about 4 to 5 feet being allowed, which has always been found sufficient (Fig. 24). A vein is laid bare by an incision 2 to 3 inches long (usually in the arm—when both arms have been used the saphena is next tried), with antiseptic precautions, and tied. The cannula is introduced and tied in above the ligature, the pinch-cock is opened, and the whole quart is infused in two to four minutes. The effect is sometimes astounding. The cyanotic, algid, pulseless, breathless creature, with shrunken, wrinkled features, sunken, lack-lustre eyes, and the whole aspect of a moribund, will, as if from a deep sleep, arouse himself and tell the delighted doctor he feels vastly better."

If the injections are made subcutaneously, as Cantani advises, it is desirable, owing to the large quantity that has to be injected, to introduce it at two or three places. The hypochondriac regions are usually selected.

Liebermeister aptly suggests that these injections would be more likely to be attended with *permanent* good effects if they were begun earlier, before the vital organs (heart, kidneys, etc.) had been so gravely injured by the loss of water.

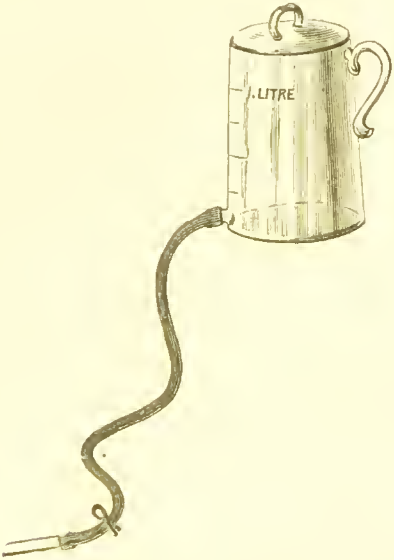

Fig. 24.—Vessel used for Intravenous Injections.

Subcutaneous injections of camphor dissolved in olive oil (20 minims) every half-hour or hour have been often combined with the above method, with great advantage in the algid state. Ether, strychnine, and digitalin have been injected subcutaneously for threatened cardiac failure.

Other measures of minor importance have been found useful in dealing with certain symptoms. To restore warmth and circulation prolonged hot baths (half an hour) at a temperature of about 100° F. have been used, and after the bath a very large hot mustard poultice has been applied over the whole of the abdomen and lower half of the chest. This measure has been found very useful in many cases, but in the *algid* state it will be better to have recourse to the large hot rectal injections and the subcutaneous injection of hot saline solutions. Some, however, consider hot baths more exhausting than beneficial, and prefer hot fomentations, hot sandbags to the feet and legs, and friction with the warm hand. The *painful cramps* are relieved by these hot applications, by firm rubbing with the hands, and also by subcutaneous injections of small quantities of morphia. The *vomiting* may be relieved by sucking ice, by iced champagne, or by a few small doses of cocaine with chloroform; or, as we have mentioned, by washing out the stomach.

To relieve the *thirst*, hot tea and coffee, toast and water, and in the collapse stage hot water, should be given freely, avoiding, however, over-distension of the stomach.

A small amount of brandy or whisky may be added to the hot tea or coffee, and champagne diluted with seltzer may be given, but large quantities of strong alcoholic stimulants are not well borne.

During the febrile reactionary stage much caution must be observed in feeding the patient; we should prescribe a spare liquid diet and copious diluent drinks, such as Apollinaris or seltzer water mixed with warm milk; if constipation occurs, a mild saline like Carlsbad water is the best aperient. During the convalescent period a tonic of quinine and hydrochloric acid is required, and for some time only light, chiefly fluid, food should be allowed.

The treatment that has been found to answer best in the latest European epidemics may be thus summed up:—In the early stage gentle purgatives to aid the natural efforts at elimination of the infective microbe and the toxic substances it elaborates; opium liniment externally, or small doses of morphine hypodermically, to relieve pain and cramp; intestinal antiseptics, of which calomel is the best, to neutralise the toxic action of the comma bacillus in the intestine, and bismuth to protect the denuded intestinal membrane; avoidance of the use of opium for the purpose of checking diarrhœa, the drug being reserved for the relief of pain and for its soothing effect on the nervous system; hot large intestinal injections of tannin; in the algid state, the intravenous or subcutaneous injections of large quantities of hot saline solutions; the subcutaneous injection of camphor to stimulate the circulation, and hot baths and other hot applications to maintain the heat of the body; and the various remedies mentioned to relieve special symptoms.

Epidemic Cerebro-Spinal Meningitis, or Cerebro-Spinal Fever

This interesting disease is also known by the names *spotted fever* and *malignant purpuric fever.* It is caused by an *infective* micro-organism known as the *diplococcus intracellularis meningitidis,* and is attended by inflammation of the cerebro-spinal meninges. It is a very fatal disease, and occurs in epidemics, and also sporadically. In the latter form it is closely allied to, if not identical with, what is known as post-basic meningitis. The epidemics are rare in this country, but are not uncommon in America. The outbreaks are usually localised and not widely diffused, and are apt to occur where persons are crowded together, as in barracks, jails, and asylums. Children and young adults are most prone to be attacked, and especially young soldiers and recruits. Physical and mental depression and exhaustion are predisposing causes. It does not appear to be highly contagious, and cannot be conveyed, as scarlet fever can, by a second person to a third. But in some epidemics it has appeared to be communicable from person to person.

It cannot, however, be conveyed through the atmosphere, like measles or scarlet fever. One attack does not properly immunise. The mode of communication is believed to be through the secretions of the mouth, nose, and conjunctiva, for the diplococcus dwells on the mucous membranes of these localities. This micro-organism has been found in all authentic cases of this disease, and has been isolated from the blood of such patients. It is interesting to know that the *diplococcus intracellularis* has been found in the nasal secretions of healthy individuals, and that it closely resembles the *diplococcus catarrhalis*, which occurs there normally. It has also been found in the bronchi in pneumonia, as well as in the pus of the complicating joint affections. The diplococcus associated with sporadic post-basic meningitis is probably a slightly modified example of the same organism.

The anatomical changes, as shown in post-mortem examinations, are those of a suppurative or fibrino-purulent lepto-meningitis of the brain and spinal cord. The amount and distribution of the inflammation are variable. Micro-organisms are found in the exudation.

Malignant, ordinary, and anomalous forms have been described. In the *foudroyant* or *malignant* form the onset is sudden, usually with rigors, vomiting, headache, somnolence, muscular spasms, great lassitude and a moderate rise of temperature, and a slow, feeble pulse. There is usually a purpuric rash. In this form death, preceded by unconsciousness, is often very rapid—sometimes after only a few hours. In the *ordinary* form the onset is also sudden, with rigors, occipital headache, and vomiting. Painful stiffness of the muscles of the neck is an early symptom. The pulse is full and strong and the temperature is raised to 101° or 102° F. The head may be drawn back from contraction of the neck muscles, there is much pain in the back and limbs; with increase of headache there is dread of light and sensitiveness to noise, irritability and restlessness. Muscular tremors occur with tonic or clonic spasms in the limbs, and rigidity of dorsal and cervical muscles, so that the occiput may be drawn back till between the scapulæ. The facial muscles may be involved in spasm, and strabismus is common. There is often great tenderness along the spine. Delirium occurs early and may become violent, but yields in a few days to stupor, which passes into coma as the effusion increases. Great variability has been noted in both pulse and temperature. There is much variability also in the occurrence of cutaneous symptoms; *herpes* is very common, petechial and other eruptions are sometimes present and sometimes absent. Leucocytosis is marked and constant. Albumen is sometimes found in the urine. At the onset vomiting may be severe. The bowels are usually confined.

Extreme variability in its course and manifestations is characteristic of this curious disease. It is often fatal within the first few days, while other cases will go on for months. Signs of improvement are fall of temperature, diminution of spasm, and return of intelligence. Convalescence is slow, and liable to interruption from complications and sequelæ.

Remarkable *anomalous* forms occur. There is an *abortive* form in which, after a severe onset, the symptoms subside in a day or two and convalescence is rapid. There are also *mild* cases in which the symptoms are so vague that they could not be recognised except during the course of an epidemic. An *intermittent* type has been described with an intermittent or remittent pyrexia, as in pyæmia. *Chronic* forms have also been met with which have persisted for three to six months.

Numerous *complications* are mentioned by different authors as more or less common in this disease—pneumonia, pleurisy, pericarditis, parotitis, *polyarthritis*, chronic hydrocephalus, persistent headaches, etc. etc. Sequelæ affecting the eye and ear are not uncommon, as might be expected in a disease of this character. The presence of nasal catarrh has an especial interest in connection with this disease, as it has been suggested that the meningitis may originate in an infective rhinitis—for, as we have said, the nasal secretion often contains diplococci.

A certain diagnosis can usually be made by means of a lumbar puncture, which is also employed as a therapeutic measure. This operation is performed in the following manner: In children it is best to give an anæsthetic—then the patient is turned on the right side, with knees drawn up and back bent; a small aspirating needle, guided by the thumb and index finger of the left hand, is inserted to one side of the median line in the interspace between the laminæ of the third and fourth lumbar vertebræ, and thrust deeply upward and inward until it reaches the spinal canal. The spinal fluid escapes drop by drop, and if meningitis is present it is generally turbid, and sometimes purulent or bloody. The presence of the diplococcus is positive evidence of the nature of the disease, but even in its absence an examination of the cellular elements may afford means of differentiating between a meningitis of tubercular and one of other origin. (*See* Tubercular Meningitis, p. 242.)

Treatment in these cases is not very promising, the death-rate varying in different epidemics from 20 to 75 per cent. The mortality is much greater in children than in adults. It is difficult in a disease of this kind to formulate any rational indications for treatment. The search for a *specific serum* does not appear to have met with success, although we shall have to refer to some recent observations which seem to point to a contrary conclusion. Dr. Koplik* states, as the result of his large experience, "There is no serum as yet which will aid us in conquering the affection. . . . We have nothing to cut short the disease. . . . The reported success of certain remedies in particular epidemics is due to the mildness of those epidemics." It seems difficult to justify so sweeping an inference as this last. Quite recently* Dr. Gardner Robb, of the Belfast Fever Hospital, has recorded some observations of a most favourable kind as to the usefulness of Flexner and Jobling's antimeningitis serum given by intraspinal injections. He had tried three other varieties of antiserum previously without any satisfactory results. Between September 1st and December 31st, 1907, 32 cases had come under treatment, and they were all treated with intraspinal injections of Flexner and Jobling's serum. Of these 32 cases, he says, "22 have recovered, 8 have died, and 2 are still ill." Of the 275 cases previously treated, 199 died, equal to a mortality of 72 per cent. To reduce this mortality to 26·6 per cent. seems a remarkable result. Was this a *particularly mild epidemic?* Dr. Robb thinks not, as in cases treated at their own homes during the same period the mortality was 85·2 per cent. Dr. Robb mentions that Flexner and Jobling, of the Rockefeller Institute for Medical Research, New York, have published a first list of 47 cases treated in this way with a mortality of 27·6 per cent.

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* Osler and McCrae's "System of Medicine," vol. ii., p. 517.

We give the technique and dosage in Dr. Robb's own words :—

Method of Injection

The antiserum is supplied in 15 c.cm. bottles. Before use it is brought approximately to the temperature shown by the patient by allowing the bottles to stand for a sufficient time in water at, or a little above, that temperature. Chloroform has been given in all cases. A rigid and comparatively large trocar is used—one of medium size from a Potain's aspirator answers very well; to the effluent pipe of this a short rubber tube is attached. The puncture is made and as much fluid as will is allowed to drain off; suction is very seldom necessary; if the amount of fluid obtained is not great, it can often be increased by raising the patient's head and shoulders. The barrel of a Roux serum syringe is then attached to the rubber tube and held upright, and the serum is slowly poured into it from the bottle. Occasionally the 30 c.cm. will flow in without pressure: more commonly about 20 c.cm. will flow in in this way, the remaining 10 c.cm. being slowly injected by means of the piston. I have not so far seen any symptoms which would indicate undue pressure follow.

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* *British Medical Journal*, February 15th, 1908.

Dosage

Much further experience will be necessary before any definite statement on this head can be made. Flexner and Jobling recommend that in severe cases 30 c.cm. should be given every twenty-four hours for three days, and then if further injections appear necessary, that they should be given as the symptoms seem to demand. In our earlier cases we used the serum more sparingly, two or three days or more being allowed to elapse between the injections. At present I am inclined to adopt the following plan: If the case is very severe, and especially if pus is found in the fluid obtained by lumbar puncture, to give 30 c.cm. or larger doses every day for three days (in one of our recent cases 70 c.cm. were injected within the first twenty hours after admission, with apparently good results). In cases not so urgent I think it better not to repeat the injection until after a lapse of forty-eight hours. In this way only can the effect of the smaller dose be estimated, as the full effect of a single injection is not always apparent until after forty-eight hours or longer. Some of our results have been very good after a single injection of 30 c.cm.; in other cases improvement has only been observed after repeated doses. The largest amount yet given in a single case with us has been 210 c.cm. intraspinally. I have not as yet seen any undesirable symptoms follow the use of the serum.

The author of the paper does not wish to do more than suggest further trials of this serum. Morphine given hypodermically has been commended as useful in quieting the restlessness and irritability, in relieving pain and in procuring sleep, and it tends to relieve the distressing vomiting. But this is contested by Dr. Koplik, who says: "Morphine seems to be directly harmful in the majority. It does not relieve the pain and in some cases makes them more restless than before. Bromide of potassium and chloral hydrate seem to be the only remedies that have given any relief so far as pain and headache are concerned." Recovery has been reported to follow *lumbar puncture* in certain cases. The lessening of the tension which follows this simple operation for the removal of cerebro-spinal fluid appears to be attended with good effects, and it is just possible that it may be advantageous to remove some of the infective toxines secreted by the diplococci as well as a proportion of the micro-organisms themselves. At any rate there seems no good reason why it should not receive further trial. In robust patients the application of wet cups to the nape of the neck has been found to relieve pain. Ice-caps and ice-bags have also proved useful in lessening the headache and spinal tenderness. Koplik says "the only measure which seems to relieve the vast majority, if it can be applied, is the hot bath"; he has found it give "excellent results in relieving the restlessness and pain and to a certain degree abating the fever. Patients can tolerate two full baths in the twenty-four hours of a temperature of 107° to 110° F. After such a bath the patients are not so restless and fall asleep for an hour or two, during which time there may be a pronounced perspiration." This consistently sceptical author has nothing to say in favour of *lumbar puncture*, which he describes as "the one modern measure which has raised hopes only to cause disappointment"; and again he remarks, "in every epidemic we see marvellous results not only with simple lumbar puncture, but sometimes when absolutely nothing has been done." But he admits that in some cases this remedial measure is indicated. "In those cases of sudden onset with symptoms of complete collapse, due to intraventricular pressure, for such lumbar puncture is a measure of the highest utility, inasmuch as such pressure is very dangerous. When lumbar puncture is made twenty-four hours after the onset, after such a period of collapse, the fluid sometimes spurts several feet. In such cases the relief of the intraventricular pressure is really a life-saving procedure." He would adopt it also when "headache and delirium are excessive," also when during convalescence the patient suddenly develops symptoms of hydrocephalus; in such cases he would repeat the operation at short intervals until the symptoms disappear.

Blisters have not been found beneficial, but the application of Paquelin's cautery lightly to the skin of the back of the neck has been thought useful. Improvement has been said to follow the hypodermic injection of perchloride of mercury. Potassium iodide has been strongly advocated by some observers. Calabar bean, ergot, and large doses of quinine have all been tried, but neither of these drugs has commended itself to general adoption.

In the sporadic post-basic cases good results have been recorded from repeated lumbar puncture, from the intraspinal use of antiseptic solutions, and from the subcutaneous injection of Ruppel's serum.

To relieve the vomiting an ordinary effervescent saline draught with a few drops of hydrocyanic acid and a few grains of sodium bromide has been found of service.

Constipation is best treated by enemata of warm soap and water, with which a teaspoonful or two of castor oil may be mixed.

During the continuance of pyrexia the diet should be fluid but nutritious—milk, clear soups and broths; and stimulants, such as whisky or brandy, when cardiac weakness becomes evident. With some patients difficulties have occurred in attempting to give them food in the ordinary way, and forced feeding with the stomach-tube has been resorted to.

Convalescence is often remarkably protracted, and is frequently attended with great emaciation, debility, and severe headache; tonics such as quinine and iodide of iron are needed, and for the headaches phenacetin with caffeine, or bromides, may be prescribed.

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